Junior
Secondary
Science
Project

Cheshire

How mammals function

Contents

Harold J. Pollock

This booklet is for you to work through at your own pace. You may spend as much time as you wish on any of the sections. Your teacher will be able to help you if you get stuck, but try to think things out for yourself first. You will also be able to discuss any problems with your classmates who have reached the same stage as you.

Look at a mammal

In this unit you will be looking at some of the processes that take place in living things, and in particular in the group of animals to which man belongs—the mammals.

You may know something about mammals already. They belong to the group of animals called vertebrates and, like all other animals in this group, they have backbones. They are warm-blooded, have hair on their bodies, at least at some stage in their lives, they feed their babies with milk from their **mammary glands**. Mammals also differ from other animals in brain development: they have the ability to learn from experience.

Like most other mammals, dogs feed their young with milk from their mammary glands.

ASEP

In this section you will be observing a live mammal. You will need a live mouse in a large jar. If there is a colony of mice nearby, your teacher may prefer that you observe the whole colony instead of a single mouse.

Put the jar containing the mouse in front of you and sit still so that the mouse will settle down and behave as naturally as possible.

Watch the mouse and note all the different parts of the animal which you can see.

In your workbook, under a suitable heading, describe your mouse.

2 Collect some food and water and place it in with the mouse, being very careful not to startle the animal.

Sit very still and keep quiet while you watch the mouse.

Wait until it is still and see if you can detect slight movements of its chest. What do you think these movements are?

Watch very carefully everything the mouse does.

In your notebook, under the heading 'Activities of a mouse', describe the things that you saw your mouse do. Did it feed or drink, for example, or produce droppings, or prick up its ears, or pass out urine? Include as many activities as possible.

When you have described all your observations, draw up a table like the one below. On the left of the table is a list of activities carried out by living things. Copy these and then, from your observations, write in the right-hand column an example of each type of activity. For example, you may have seen evidence that the mouse heard a noise, so opposite 'sensing' you might write 'pricked up its ears'.

Activity	**Observations**
Movement from one place to another	
Feeding	
Drinking	
Sensing	
Passing out waste material	
Breathing	
Other activities	

Breathing

You probably observed that your mouse was breathing. Do you know what the air the mouse breathes is used for?

Is anything *added* to the air while it is inside the mouse?

Is anything *removed* from the air while it is inside the mouse?

The animal must breathe *in* to obtain oxygen. Why must it breathe *out?*

Think about these questions before you read on.

In the process of breathing, the following things happen.

1 Air is breathed in and out through the nose or mouth.

2 The chest expands and contracts when the animal breathes.

3 There are organs in the chest called lungs, which fill up with air and empty again.

4 While the air is in the lungs, some oxygen is removed and some carbon dioxide is added.

Can you *work out* what lungs might need to be like to perform their function? Later you will dissect a mouse and see its lungs. Before you do this, try to predict what you will find. For example:

Do you think that the lungs are in the mouse's chest or abdomen?

Are they large or small compared with the size of the mouse?

How many lungs are there?

Do you think that the mouse's lungs are hard like bone, or soft and spongy?

Are the mouse's lungs connected to its mouth and nose?

Complete the sentences below in your workbook, choosing what you *guess* is the correct word where there are alternatives.

I predict that there (is/are) (one/two/more than two) (lung/lungs) in the (chest/abdomen). I predict that they are (hard/soft and spongy) and are (connected/not connected) to the nose and mouth.

The mouse breathes air in through its nose and mouth. What happens to the air then?

4 **Eating**

Your mouse probably ate some of the food you gave it. Not all the food an animal eats is useful and some of it is later removed from the body. This unused food is passed out through an opening called the **anus** and is called **faeces** (pronounced *fee*-sees).

Lin Bender

Lin Bender

When food is eaten, it enters the digestive system, where certain substances are added to it. Some of the food is then used up by the body and some leaves the body again as faeces.

In some ways the digestive system is like the breathing system, but there is an important difference.

In the breathing system, air passes in and out of the body through the same opening.

In the digestive system, food enters through the mouth, but faeces leave through the anus.

Do you think the digestive system is like a bag, with one opening, or do you think it is like a long tube between the mouth and the anus, or do you think it is like neither of these?

Make your prediction by completing the following sentence in your workbook.

I predict that the digestive system will be like a (tube/bag).

Have a closer look

You have examined a living mammal and predicted the arrangement of its breathing and digestive systems. Now you can examine a mouse more closely to see how accurate your predictions were.

You will need a dead mouse, a dissecting board and a blunt probe.

An external examination

Place the mouse on its back on the dissecting board.

1 Locate the mouth, nose and tail.

2 Using the probe to move aside the fur if necessary, locate a small opening near the tail. This is the **anus**.

3 Using the probe, locate the opening of the sex organs near the anus. This opening is further away from the tail than the anus. In mice, both the female and the male have one opening both for sex organs and for urine.

4 Feel the chest of the mouse with your fingers. Feel the ribs under the skin.

5 Feel the lower half of the body with your finger tips. Is it soft or hard?

6 Feel around the sides of the chest and abdomen to find the **mammary teats**. If you cannot find them, your animal may be a male or a young female.

Collect a copy of Worksheet 1, fix it in your workbook and fill in the missing labels on it.

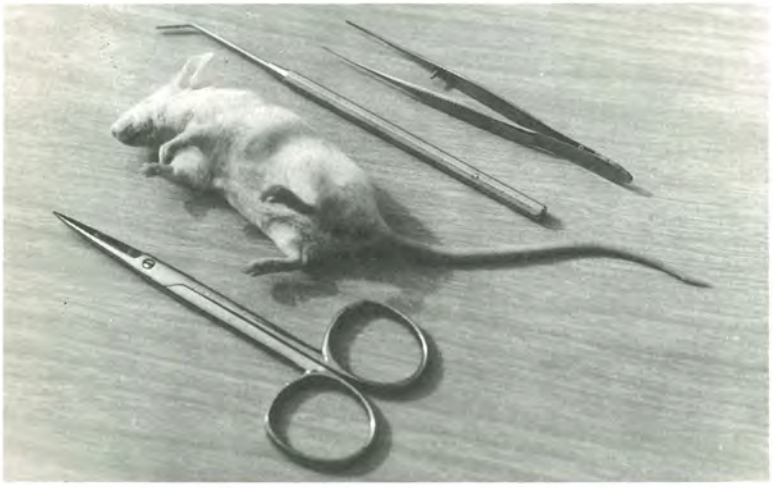
Ask a classmate to check whether your labels are correct.

Dissecting a mouse

6 For this you will need a dead mouse, a dissecting board, a pair of sharp-pointed scissors, some forceps (preferably sharp-pointed), a blunt probe and some cotton wool to mop up blood.

'Dissect' does *not* mean simply 'cut up' the mouse. If you cut carelessly you will damage the structures and will not be able to find those you are looking for. Cut only when you know what you are cutting. The photographs and directions below will help you. Follow them step by step.

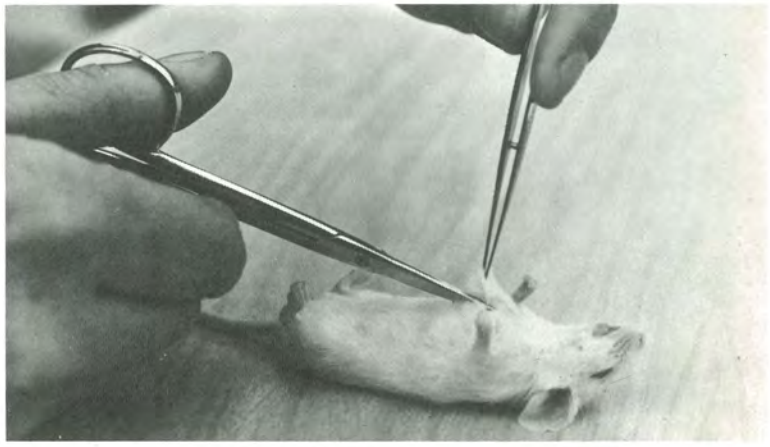
1 Ready to dissect.



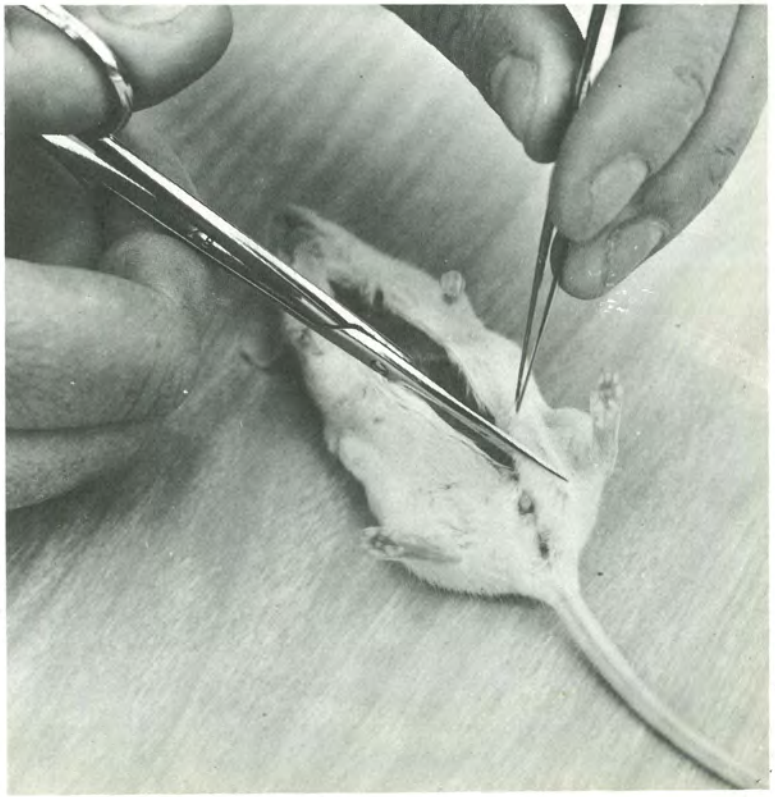
2 Pull the skin upwards in the mid-abdominal region with the forceps and make a small cut with the scissors blade held horizontally. If you point your scissors downwards, you may damage other parts.

This series of photographs is by Alastair B. Traill

3 Stretch the skin flap away from the underlying muscle. Insert the point of the scissors carefully between the skin and the muscle. *Slide* the scissors through the skin along the animal's midline up to its chin—snipping is tedious and may damage underlying tissue.

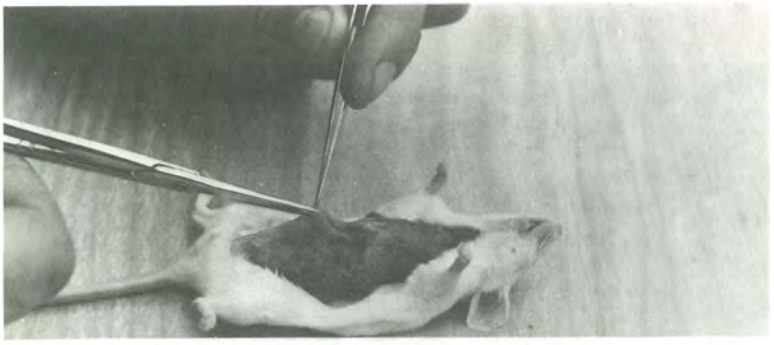


4 Open up the skin towards the tail. Slide the scissors to one side of the sex organ openings.

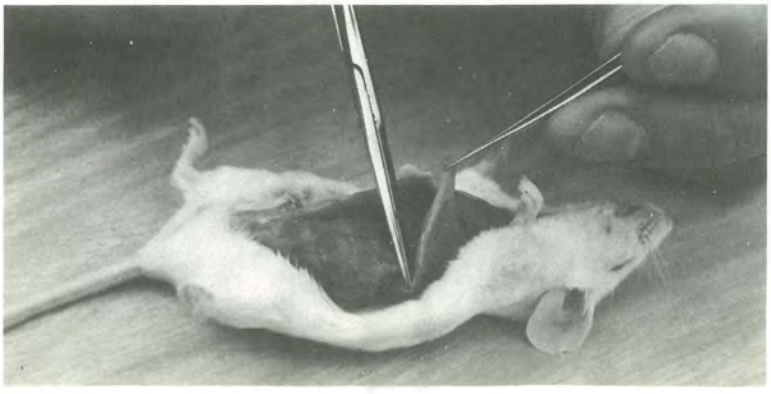


5 Tear back the skin very carefully. The end of the white breast-bone can just be seen under the body wall.

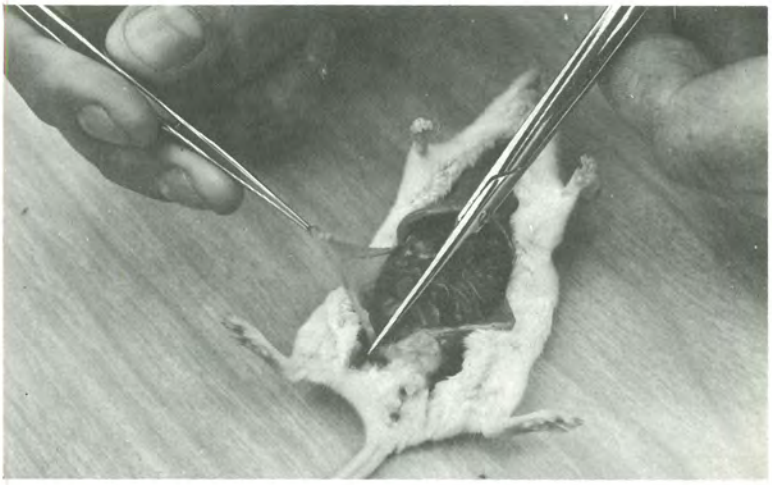
6 Stretch the body wall upwards in the mid-abdominal region and make a small cut. To open the body cavity, lift the body wall at the place where you made the small cut, and cut foward as far as the end of the white breast-bone.



7 Cut the body wall along the line of the lowest rib on each side of the breast-bone.

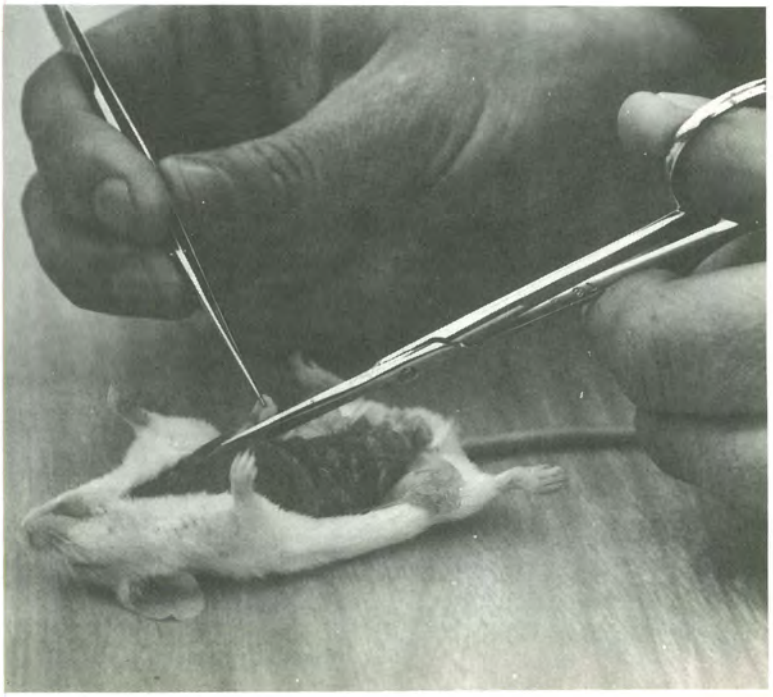


8 Cut backwards to the base of the body cavity. Keep to one side of the sex organ openings.

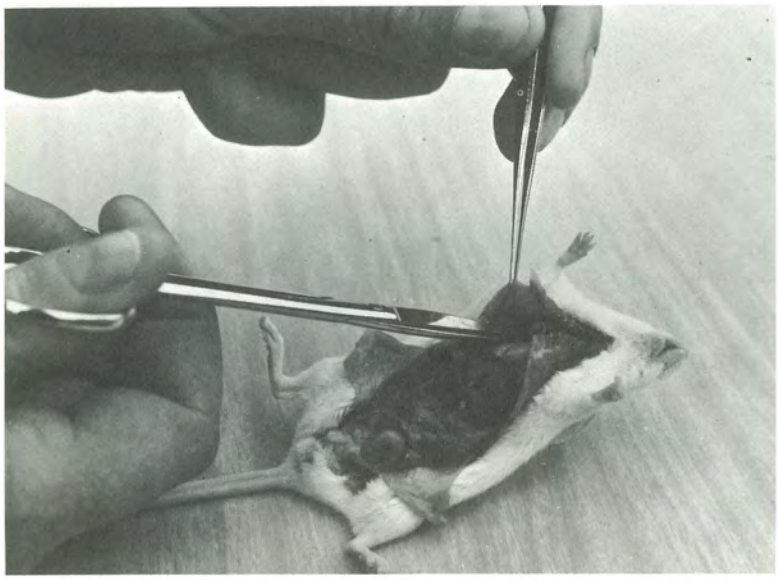


9 Lift the breast-bone by holding the piece of soft cartilage at the end of it. Slide the scissor point between the breast-bone and the cartilage. Cut.

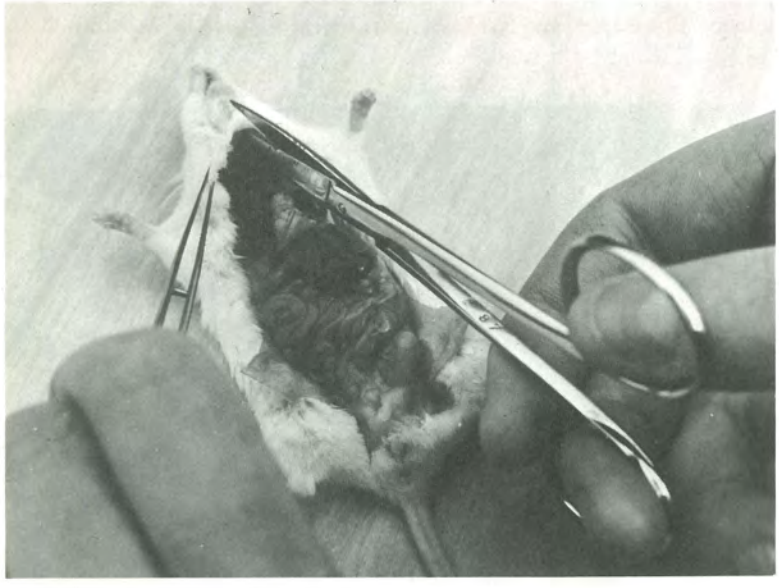
Keep the lower blade of the scissors horizontal and lift the breast-bone with it when cutting along the midline of the chest. Poke the lower scissor point underneath the collar bone and cut.



10 Cut up through the rib cage on both sides and remove the ribs.



Your dissection should now appear something like this:



Find the mouse's glands at the neck and remove these, using your forceps and scissors. Be careful not to damage the structures underneath. If the mouse bleeds, mop up the blood with cotton wool.

Finding the parts

1 In the neck of the animal is a small tube which has tiny ridges around it. This is the wind-pipe or **trachea** (pronounced track-*ee*-ah). Find it with your probe.

2 Near this, centrally placed, is the **heart**, a compact red organ which is firm to touch.

3 With forceps, lift the heart. Underneath and to the sides are the **lungs**, which are pinkish in colour. See if you can locate where the trachea opens into the lungs. Look back in your workbook at the predictions you made about the lungs. Were your predictions correct?

4 The **liver** is the large, shiny deep-red organ lying below the lungs and on top of other organs.

5 Find the **stomach**, a pale-coloured, bag-like structure, which is almost covered by the liver.

6 Next to the stomach and nearer the tail of the animal is the coiled tube called the **intestine**.

Obtain a copy of Worksheet 2 and fix it in your workbook. Label the diagram on it.

Ask a classmate to check whether your labels are correct.

Some of the organs connect to form 'systems'

12 You have located some of the larger organs in the mouse. Next you will be looking in more detail at their arrangement in the body.

The digestive system

You will need to push aside the heart and lungs, and you may have to cut away most of the liver to see the structures underneath.

1 Locate a small pale tube alongside the trachea. This is the **oesophagus** (pronounced ee-*sof*-uh-gus).

Find the oesophagus on the diagram on Worksheet 2 and label it.

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2 Push the probe under the oesophagus *very gently* and lift slightly. You may see the stomach move a little. Why?

3 Inside the mouse, near the anus, find a structure containing partly formed faeces. This is part of the intestine.

4 Gently pull the intestine to one side with your fingers or forceps. Very carefully unravel the intestine until you have traced it back to an organ you already know. Use a probe to help with this.

Can you trace the path which food travelling from the mouth to the anus would take? Use a probe to do this.

5 Look back at the prediction about the shape of the digestive system that you wrote in your workbook. Were you right?

The urinary system

You already know the opening through which urine passes out of the mouse. Inside the mouse, near this opening, find a thin-walled bag, possibly containing liquid. This is the **bladder**.

Very gently squeeze the bladder with forceps. What do you observe?

Now, using forceps and scissors, very carefully remove the liver, heart, breathing system and digestive system, but nothing else.

Wrap these in paper and place them in a waste bin.

With forceps, stretch the bladder backwards to find two very thin white tubes connected to the back of the bladder. These are the **ureters**.

Alastair B. Traill

Hold one ureter in your forceps and trace it back away from the bladder. You may need to clear away some of the surrounding tissue with your probe.

The structures from which the ureters come are the **kidneys**.

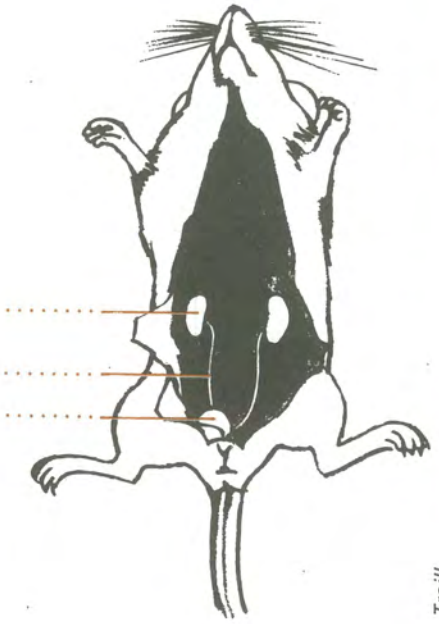
Trace both ureters back until you find the right and left kidneys.

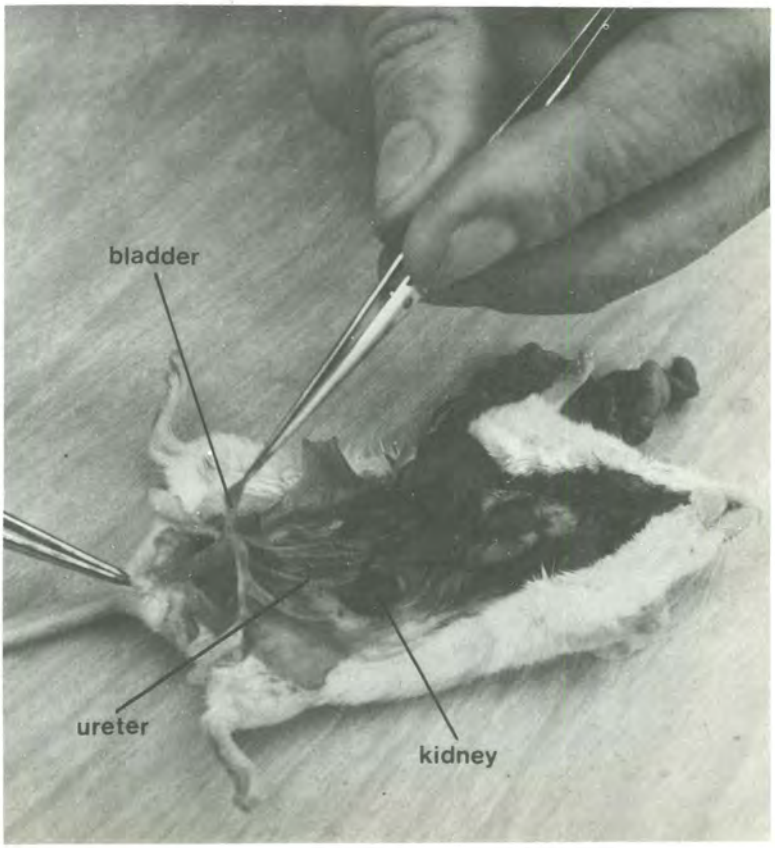
Urine is formed in the kidneys and travels down the ureters to the bladder.

Draw a diagram similar to the one below, showing the urinary system of a mouse. Label the various parts shown.

If you wish to dissect your animal further, have a look at the research activity 'Muscles and movement' on page 56.

When you have finished, clean your instruments and place the wrapped remains of the mouse in the rubbish bin.





Alastair B. Traill

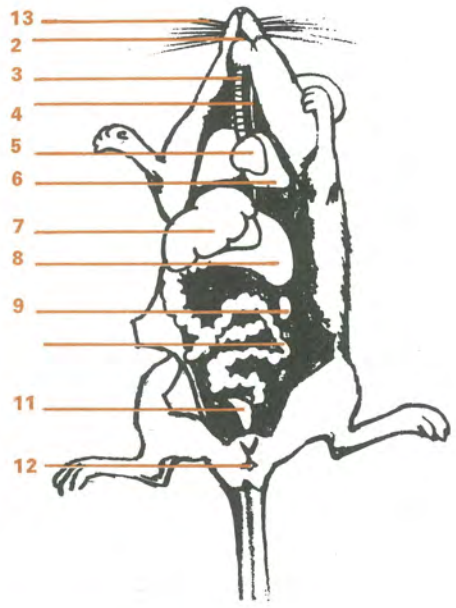
Progress check 1

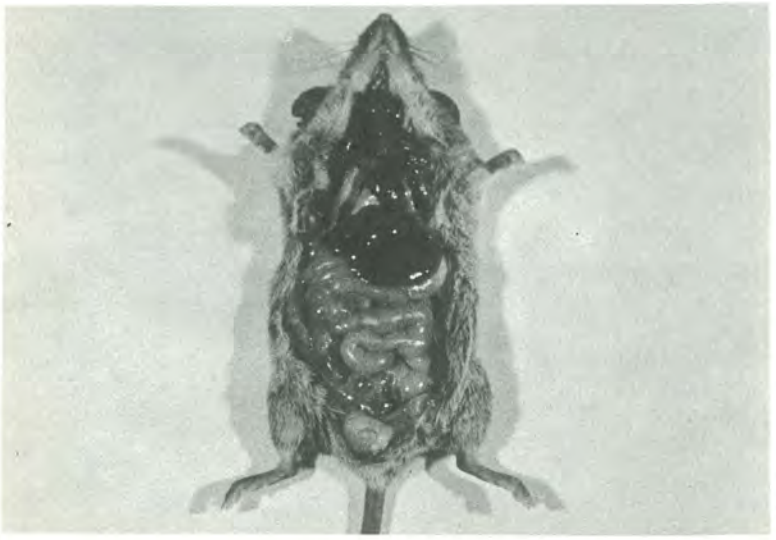
14 1 Test your spelling of these words. Write each word in your workbook as a classmate reads it out.

trachea	oesophagus
stomach	faeces
kidney	intestine

For Questions 2 to 12, select the word from the list on the left that corresponds to each number on the diagram, e.g. 13 whiskers.

mouth
heart
intestine
trachea
kidney
oesophagus
liver
bladder
anus
stomach
lung
ureter





ASEP

Turn to page 60 and check your answers.

What does each part of the body do?

When you examined your dissected mammal, you saw structures which are involved in various types of activities. For example, you saw the lungs, which are involved in breathing.

Draw up a table in your workbook like the one below. Name the structures used in each activity by choosing from the list below the table.

Activity	Structures involved in this activity
Breathing	
Forming and storing urine	

Structures
kidneys
ureters
trachea
stomach
heart
intestine
bladder
anus
oesophagus
lungs

Have another look at Worksheet 2.

Using one colour, shade all the organs concerned with *breathing*. Using a second colour, shade all the organs concerned with *digestion*.

Beside the diagram, put a key to show which colour you have used for each system.

Check your answers to the table against those on page 60 and then show your completed work to your teacher.

What happens to the food you eat?

16 What have you eaten in the last 24 hours?

In your workbook, draw up a table like the one below and write down, under the appropriate headings, all the things you can remember having eaten and drunk in the last 24 hours.

Food from plants	Food from animals	Food from other sources

Plants need only simple substances to sustain them. From carbon dioxide in the air, water and mineral salts in the soil and light from the sun they are able to manufacture all the more complex substances that they need to live and grow. Animals cannot do this—they must eat food which already contains the complex substances that they need.

M. R. Dixon

Can you draw any conclusions from your table of what you have eaten? What are man's main sources of food?

Lin Bender

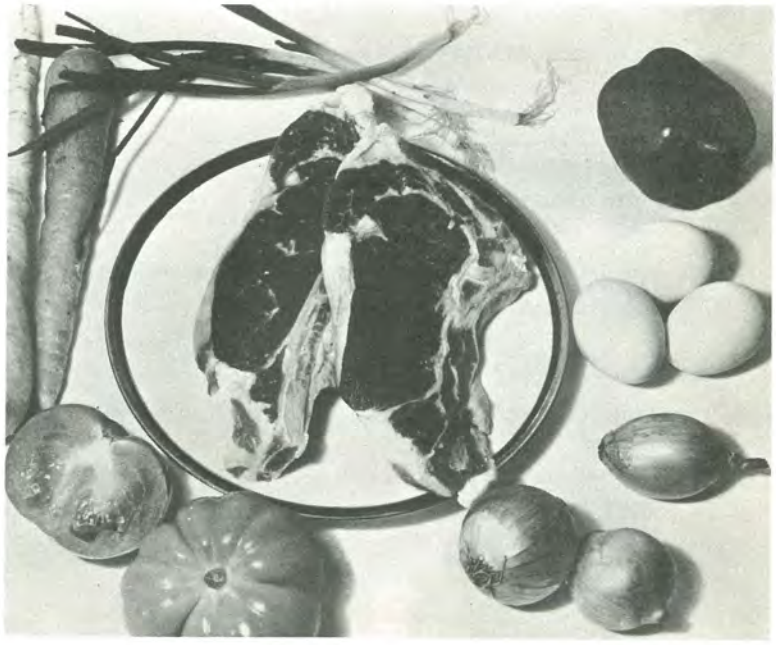
Plants are able to manufacture their food from carbon dioxide, water, mineral salts and sunlight, but animals cannot do this.

Digestion of food

Your body needs food for energy and growth, but foods such as bread, meat and vegetables cannot be used as they are. They must be changed into a form that the body can use.

This is the job of the digestive system. In the following experiments, you will be looking at some of the changes that take place during digestion.

Before foods like these can be used in your body, they must be broken down by the digestive system.

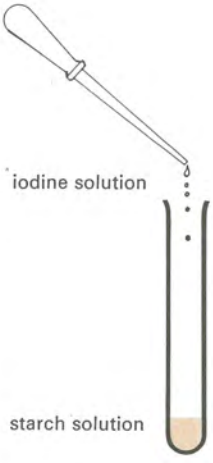


Lin Bender

Before you start on the experiments, collect a copy of Worksheet 3 and fix it in your workbook.

1 *Tests for starch and sugar*

Obtain the following equipment: four test tubes in a rack, iodine solution, Benedict's solution, starch solution and sugar solution, two beakers (one large and one small), a dropper, tripod stand and gauze, and a burner.



Iodine solution is a useful test for starch. There is a distinct colour change when it is mixed with starch, as you will see below.

Put about a centimetre of starch solution in one test tube and a centimetre of sugar solution in another.

Add a drop of iodine solution to each.

Observe the colours and then colour or label the contents of the appropriate test tubes on Worksheet 3.

Benedict's solution is used to test for one kind of sugar.

Put about a centimetre of starch solution in one test tube and a centimetre of sugar solution in another.

Add half a centimetre of Benedict's solution to each.

Put water into the large beaker until it is about one-third full and heat it. When the water is boiling, stand the two

tubes in it and leave them for a minute or two.

Observe any colour changes and then colour or label the contents of the appropriate test tubes on Worksheet 3.

Complete Worksheet 3 by completing the sentences and answering the questions.

Before you go on, clean and dry your beaker and test tubes so that you can use them in the next test.

2 *Does saliva contain starch or sugar?*

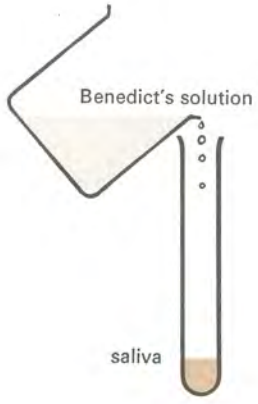
Collect a copy of Worksheet 4 and fix it in your workbook.

Produce some saliva in your mouth and dribble it into a small beaker. Add to the beaker a quantity of water equal to the amount of saliva in it, and divide the mixture up between two test tubes.

Test the contents of one tube for starch by adding *one drop* of iodine solution.

Colour or label the contents of the first tube on Worksheet 4.

Test the contents of the other tube for sugar by adding half a centimetre of Benedict's solution and heating the tube in a beaker as before.



Colour or label the contents of the second tube on the worksheet.

Does saliva contain sugar? Does it contain starch?

Enter your inferences on Worksheet 4.

3 *Does a dry biscuit contain starch or sugar?*

Crumble enough dry biscuit to occupy a depth of one centimetre in each of two test tubes. Cover the biscuit crumbs with water and shake them well.

Test one lot for starch and the other for sugar.

Indicate the colours obtained on the appropriate diagrams on Worksheet 4.

Did the dry biscuit contain starch? Did it contain sugar?

Enter your inferences on your worksheet and then show your work to your teacher before going on.

4 *Does chewed biscuit contain starch or sugar?*

Break off a very small piece of dry biscuit—about one centimetre square—and chew it thoroughly, mixing it well with saliva and rolling it around your mouth. Be careful not to swallow it. Keep it in your mouth, well mixed with saliva, for at *least* three minutes—longer if possible.

When it is soft and mushy, dribble the biscuit into a small beaker and add an equal volume of water.

Divide the mixture between two test tubes. Test one lot for starch and the other for sugar.

Colour the diagrams on Worksheet 4 to show the colours you obtained.

Does chewed biscuit contain starch or sugar?

Write your inferences in the space provided on the worksheet.

By comparing the results of the tests on saliva, on biscuit before it was chewed, and on chewed biscuit, you can learn something of the changes in the biscuit while it is in your mouth.

Which substance gradually disappears?
What new substance appears?
Where could this new substance have come from?
What could have caused the change?

In your workbook, write the heading 'Digestion in the mouth' and then write a sentence in answer to each of these questions.

1 What happens to the starch of the biscuit in your mouth?
2 What could have caused this change?
3 How did you know that it was *not* the saliva that contained the sugar?

Show your answers to your teacher.

As saliva changed the starch into sugar in your mouth, it may be possible to make it do the same thing in a test tube

that is kept warm. If you are interested in finding out whether this is possible, look at the research activity 'Starch to sugar' on page 48.

Our digestive system

Most of the food we eat must be changed before it can be used by the body. The process by which food is changed is called **digestion**. This takes place in the digestive system, which is like a hollow tube about 60 metres long.

You have seen what happens to starch in your mouth. This is part of the process of digestion. Other foods are digested in different ways and in different parts of the digestive system. All digestion, though, turns food into a form in which the body can use it for growth or for respiration.

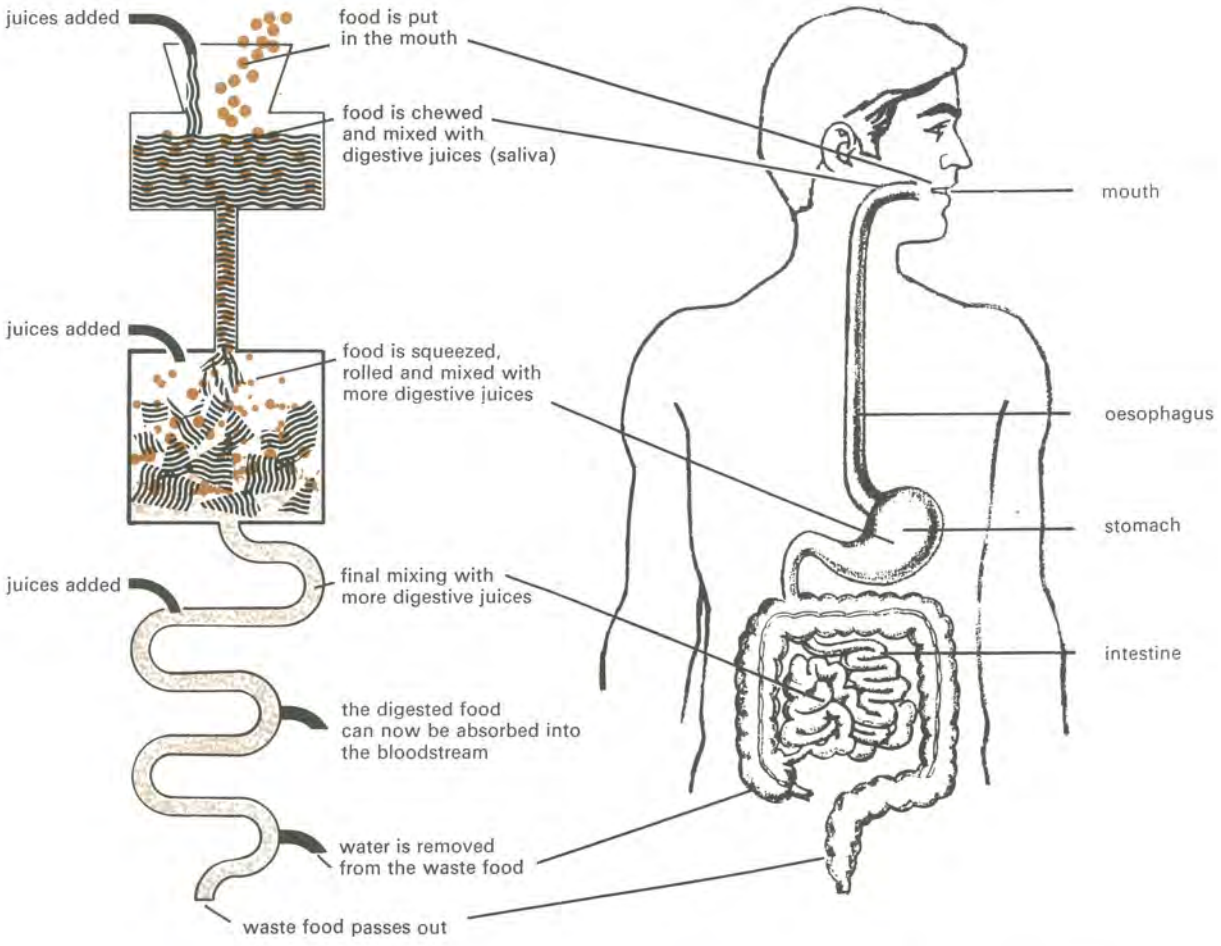


Diagram adapted from *A look at living things* by B. R. Cox and O. C. Jenks, published by Blackie & Sons.

Under the last sentence you wrote in your workbook, complete the following.

Most food (can/cannot) be used by our bodies immediately. The ..... system changes it into a form we can use.

The changes which occur in the digestive system are called .....

Transport around the body

22 All living things need energy to remain alive. Energy is released during the process of **respiration**. Respiration is a series of chemical reactions in which food and oxygen are used up and carbon dioxide, water and energy are released.

So that energy can be released in every part of the body that needs it, food and oxygen must be transported to all parts of the body.

Oxygen enters the body through the lungs and food enters the body through the digestive system. How are they carried from these two places to every part of the body where respiration takes place?

The Courier-Mail

To give your muscles energy to run, food and oxygen are needed. How do these substances get to your legs?

William Harvey

Radio Times Hulton Picture Library

In mammals the main transport system is the blood circulatory system. Understanding of the circulation of the blood has only been developed in the last three hundred years. William Harvey (1578-1657), who was physician to James I and Charles I, found that the heart pumps the same blood round and round the body. Harvey operated on different types of animals to make his observations, but you can investigate some features of the heart and circulatory system using your own body.

How are pulse and heart beat related?

For this you will need either a stethoscope or a piece of rubber tubing (about 60 cm long) attached to a small filter funnel, a stopwatch or a watch or clock with a second-hand, and a partner to work with.

Place the mouth of the stethoscope or funnel over your partner's heart. Hold the end of the tube to your ear and listen carefully. Move the mouth of the stethoscope around until you can hear the heart clearly.

Now listen to your own heart. Does it sound the same as your partner's?

Using the stopwatch, count your partner's heart beats during one minute.

When you have done this, count your partner's pulse beats during one minute by putting three fingers on his wrist. (Be sure to use your fingers for this, not your thumb, because your thumb has a pulse of its own.) If you have difficulty, ask your teacher to help.

Use three fingers (not your thumb) to take your partner's pulse.

David Pepper

In your workbook, draw up a table like the one below and enter the results next to 'count 1' for your partner.

		Heart beats in one minute	**Pulse beats in one minute**
Your partner	count 1		
	count 2		
Yourself	count 1		
	count 2		

Check your first count by repeating your observations on the heart beat and pulse rate of your partner. Enter your results in the table as 'count 2'.

Now change places with your partner so that *your* heart beat and pulse rate are counted. Repeat the count and enter both sets of readings in the table.

Can you see any connection between the rates of heart and pulse beat from your results?

Write a sentence in your workbook to answer the above question.

Show your work to your teacher before you read any further.

24 **Blood vessels**

Each beat of the heart causes a pulse in all the **arteries**, which are blood vessels leading *away from* the heart.

Try to feel the pulse beat in other arteries. You may be able to feel it just above the ridge of the bone passing from your ear to your eye. You may also feel the pulse in your throat, in the hollow of your arm, under your arm or behind your knee.

Look at the blood vessels just below the skin on the back of your hand or on your wrist. These are **veins** through which blood is travelling *back* to the heart.

Can you feel a pulse in your veins? (Feel with your fingertips, as before, *not* with your thumb.)

Harvey was able to trace the arteries from the heart, where they are quite large, to various parts of the body. He saw that they branched many times, becoming smaller and smaller. He also traced the veins from very narrow vessels to much larger vessels leading to the heart.

He realized that the tiny arteries and veins must be connected but he could not see any connecting vessels. Four years after Harvey's death, the tiny connecting vessels (called **capillaries**) were seen for the first time by Marcello Malphighi, an Italian scientist, using one of the first microscopes.

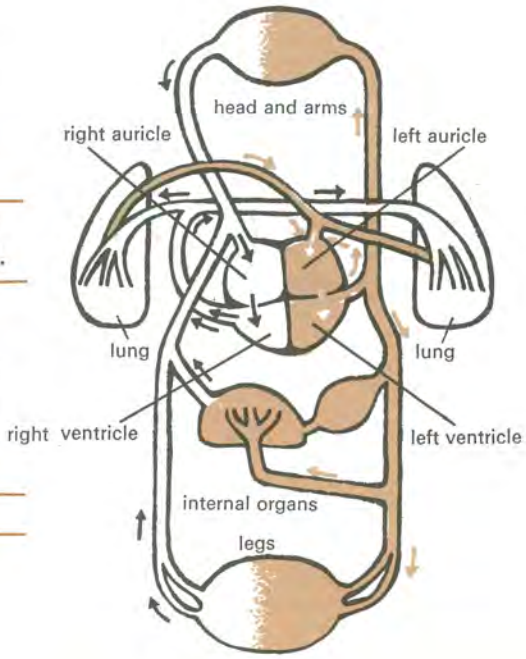
These capillaries are so tiny that the heart beat no longer causes a pulse in them. Hence, there is no pulse in the veins into which the blood passes from the capillaries. Blood flows back through the veins to the heart.

Collect a copy of Worksheet 5 and fix it in your workbook. Complete the two diagrams by labelling the parts indicated.

The blood absorbs oxygen from the lungs and digested food from the digestive system and carries them to all parts of the body. This transport of food and oxygen around the body is a very important function of the blood.

Complete the notes on Worksheet 5.

Ask a classmate to check the words you have filled in before you read any further.



The body's waste

Besides taking in the substances they need for life and growth, animals also take in substances that they do not use.

For example, most of the air that is breathed in is breathed out again.

Much of the water that is drunk is later passed out in urine.

Food that has not been digested is passed out as faeces.

Chemical changes inside the animal also produce waste materials and these are passed out. For example, the carbon dioxide produced in respiration passes out through the lungs.

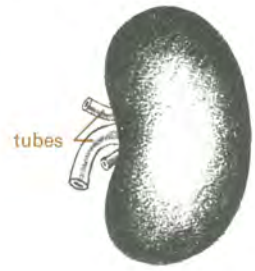
As food and oxygen are used up in the body, waste materials enter the blood. When the blood gets back to the lungs again, carbon dioxide and some water are removed from it and breathed out. Most of the other waste products are removed from the blood as it passes through the kidneys.

The removal of liquid and solid waste products is called **excretion** and the kidneys form part of the **excretory** system.

26 Examination of a kidney

You saw three parts of the excretory system—the kidneys, the ureters and the bladder—during your dissection of a mouse. Now you will have a closer look at a kidney.

1



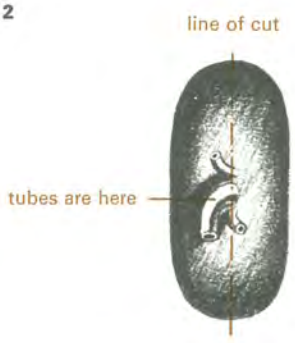
You will need a kidney, a scalpel or sharp knife, a dissecting board and a blunt probe.

Examine the outside of the kidney. Remove any fat that is on it, but be careful not to damage the kidney or the tubes leading to it.

Look for the thin white tubes attached to the kidney. Investigate these. Are they hollow? Do any of them contain blood? (See Figure 1.)

Now cut your kidney lengthwise into two halves in such a way that the tubes are left intact on one of the halves. (See Figure 2.)

2



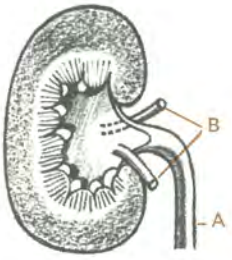
Examine the part with the tubes attached, using Figure 3 to locate the following structures:

A ureter—a tube leading from the hollow part of the kidney. (The other end leads to the bladder.)

B blood vessels—one of these is an artery and the other is a vein. The wall of the artery is thicker than that of the vein and has a whitish colour. The vein may contain dark clotted blood.

In your book make a large labelled diagram of half the kidney, showing the structures mentioned above.

3



Blood enters the kidney through the artery and leaves through the vein. The outside, darker area of the kidney contains thousands of tiny filters where some water and waste substances are separated from the blood. This mixture of substances, called urine, collects in the hollow part of the kidney and then passes down through the ureter to the bladder.

In your workbook, copy and complete the following sentences.

In the kidney, water and waste substances are filtered from the blood to form ..... This passes through the ureter to the bladder.

Dispose of the dissected kidney and clean your instruments before going on.

Progress check 2

1 Ask a classmate to check your spelling of these words.

digestion	capillary
ureter	saliva
circulatory	artery

For Questions 2 to 12, select the best answer in each case and write it in your workbook next to the number of the question, e.g. 13 (a).

2 Food is needed by animals
- (a) to provide them with energy.
- (b) to provide materials for growth.
- (c) for both growth and energy.
- (d) to dilute saliva in the intestine.

3 The main function of the heart is
- (a) pumping oxygen in and out of the body.
- (b) pumping blood to all parts of the body.
- (c) moving food through the digestive system.
- (d) making people happy and friendly.

4 The blood circulatory system enables
- (a) substances to be moved around inside the body.
- (b) essential substances to enter into the body.
- (c) food to be digested.
- (d) the animal to move around.

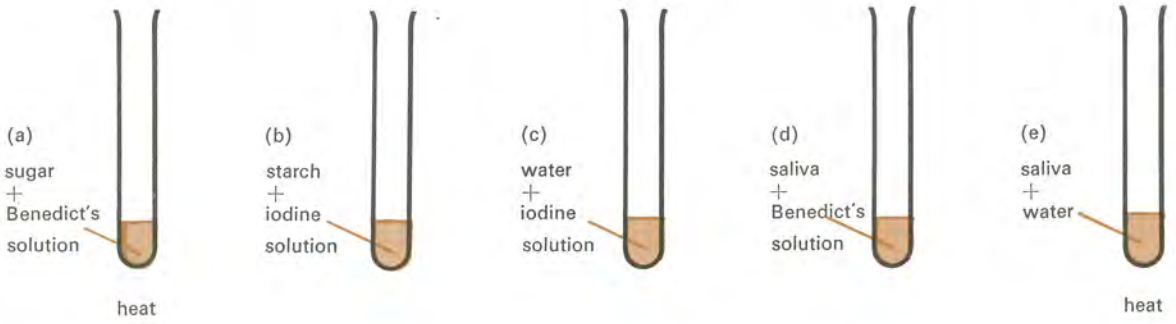
5 Digestion of starch begins in the
- (a) stomach.
- (b) mouth.
- (c) oesophagus.
- (d) large intestine.

6 The function of the kidney is to
- (a) manufacture new blood.
- (b) change complex substances to simple substances.
- (c) remove waste substances from the blood.
- (d) remove faeces from the body.

7 The blood vessels in which the pulse can be felt are
- (a) veins.
- (b) arteries.
- (c) ureters.
- (d) capillaries.

8 The chief function of the lungs is to
(a) bring the blood into close contact with the air.
(b) move the thorax up and down.
(c) cool down the body when it is hot.
(d) push the diaphragm up and down.

Questions 9, 10 and 11 refer to the diagrams below.



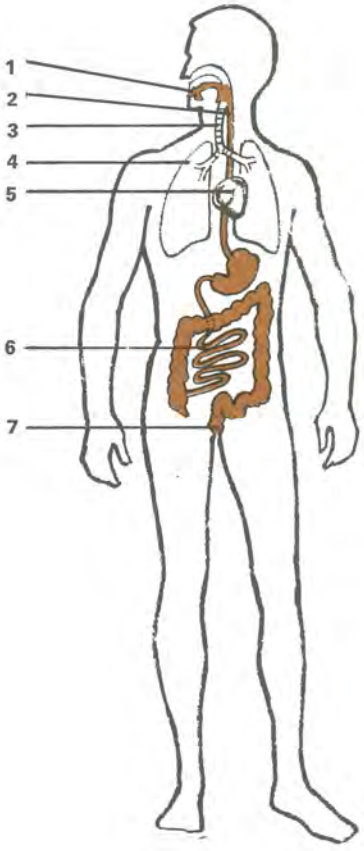
9 In which tube does the colour change to deep blue or black?

10 In which tube is the final colour transparent blue?

11 In which tube is a green or orange or red precipitate formed?

Turn to page 60 and check your answers.

Substances moving around



In any living mammal, there is a continuous movement of substances necessary for its survival. Some substances are taken into the body. Some substances are removed from the body. Many substances are transported from one part of the body to another.

On the left is a diagram showing some structures in the human body. Most of these structures are similar in shape to the structures you saw when you dissected the mouse. How many of these structures can you identify?

Collect a copy of Worksheet 6 and fix it in your workbook. Complete the first table on the worksheet by filling in the names and numbers of the structures shown on the diagram, next to the appropriate function. Copy or trace the drawing in your workbook if you wish.

Tests for food materials

You have learned how to use chemical tests to detect the presence of starch and sugar in a substance.

Complete the second table on Worksheet 6. If you are not sure what to write, refer to your workbook.

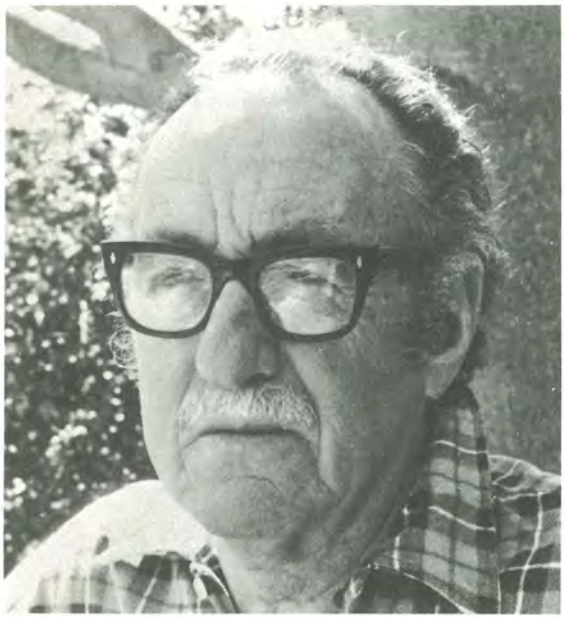
Show your work to your teacher.

Handing on life

30 Living things remain alive as long as certain functions are carried out. If all the systems of the body function normally, the organism remains healthy. Eventually, one or more systems become damaged or worn out and the organism dies.

Everything has a limited life span, and if no new individuals were produced to replace those that die, there would eventually cease to be any life on earth. The process of producing new animals or plants is called **reproduction**.

Lin Bender



P. J. Ayres

While some living things grow old...

...others are being born.

The systems we have seen so far are essential if the organism is to remain alive. The reproductive system is not essential to the organism—an organism can remain healthy without reproducing. Without reproduction, though, no new organisms would be reproduced in place of those that died.

Mammals each have two parents—a mother and a father.

The *mother* is always a *female*.

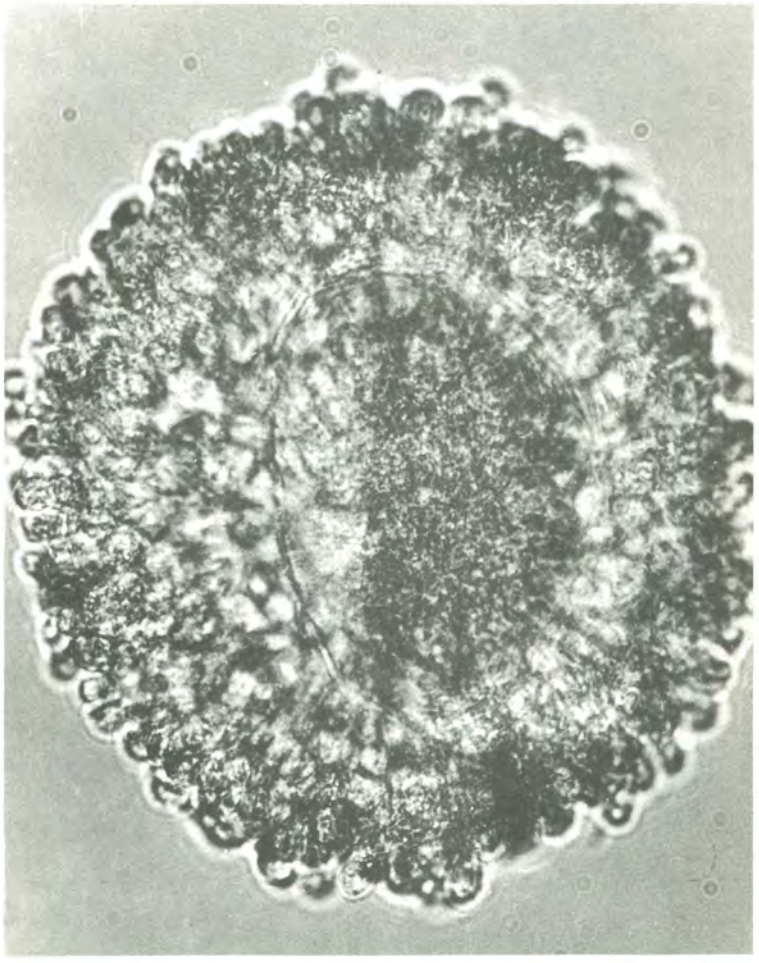
The *father* is always a *male*.

You have probably noticed that most children look something like each parent. Each child has some characteristics of its father and some of its mother.

Two-parent reproduction

Before a baby mammal can form, two cells—one from the female parent and one from the male parent—must join. This type of reproduction is called **sexual reproduction** because the parents are of different sexes.

The two parts that join are called the **gametes**. One gamete—the **ovum**—comes from the mother. This is the female gamete.



A human ovum, magnified two hundred times. Its actual size is about half a millimetre across. (Have a look at your ruler to see how big this is.)

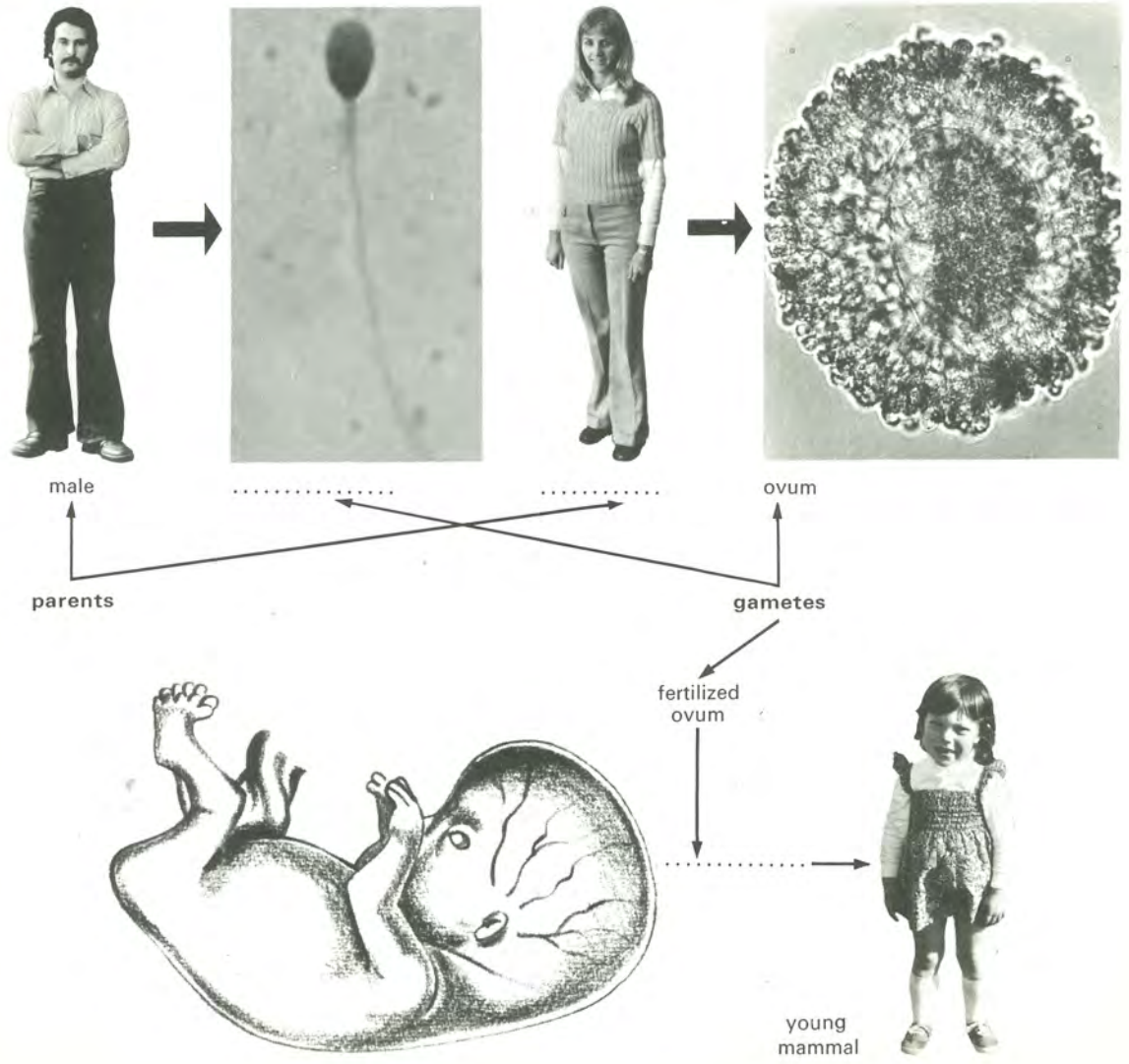
The other gamete—the **sperm**—comes from the father. This is the male gamete.

A human sperm, magnified one thousand times. Notice that the sperm is still smaller than the ovum, even though it is magnified many more times.

32 When the sperm and the ovum join, we say that the ovum has been **fertilized**. From this fertilized ovum, an **embryo**, which is a tiny new organism, develops.

You have just met several new words, and you will come across more as you continue with this section. Look through what you have just read and make sure that you know what all the words mean.

The chart below has some labels missing. Draw up a similar chart in your workbook (not necessarily with pictures), copying the labels that are there and filling in the missing ones.



A look at some dissections

Fix Worksheet 7 in your workbook.

Your teacher has prepared dissections of male and female reproductive systems. The worksheet diagrams are of rats—they will help you to find the structures in other mammals if necessary.

The male reproductive system

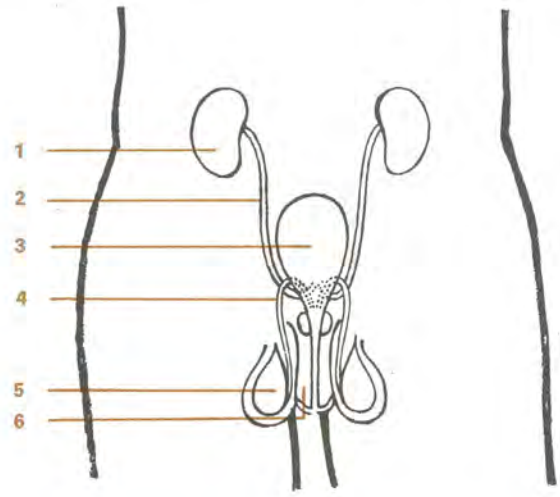
Use the diagram on the left of Worksheet 7 to find the following structures in the dissected mammal.

1 The **testes** (singular **testis**)—two pale oval structures near the anus. Here the sperm are formed.

2 The **sperm ducts**—thin tubes joining the testes to the penis.

3 The **penis**—a tube from the bladder through which urine and sperm can pass.

The diagram below shows the reproductive organs in the human male. Compare this diagram with the rat diagram on Worksheet 7 and identify the various numbered parts. In your workbook, write the label that corresponds to each number on the diagram.



Check your answers with those on page 61.

34 *The female reproductive system*

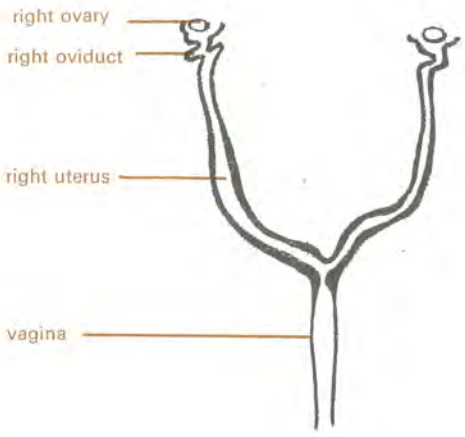
Use the diagram on the right of Worksheet 7 to find the following structures in the dissected female mammal.

1 The left **uterus** and the right **uterus** (the plural is uteri). It is in these tubes that the young animal develops. If the animal is pregnant, they will contain developing embryos.

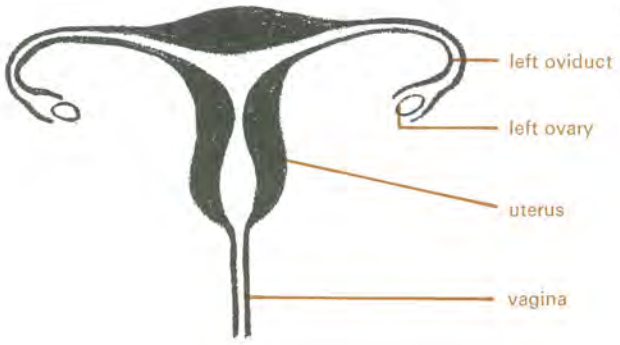
2 The **vagina**—the tube from the uteri through which the sperm enters and through which the young animal is born.

3 The **ovaries**—small, round structures at the end of each uterus. The ova (plural of ovum) are produced here.

In some animals (humans are an example) there are also **oviducts**, which are tubes leading from the uterus to the ovaries. The diagrams below show the reproductive systems in a female rat and in a female human. Compare the two.



female rat



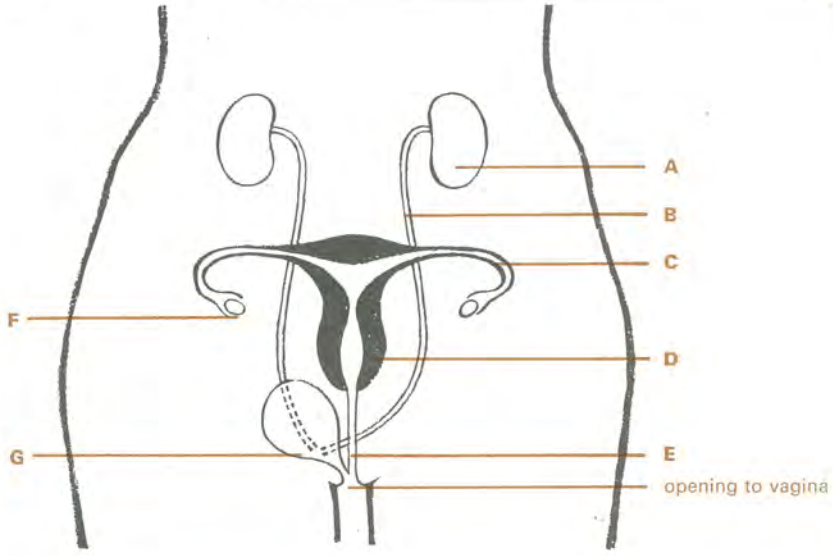
female human

How many ovaries does each have?
How many uteri does the rat have?
How many uteri does the human have?

In your workbook, write the names of the parts that correspond to the letters A to G on the diagram on the next page.

Check your answers with those on page 61.

All species of mammals have fairly similar male reproductive systems. The females differ mainly in the



number of uteri. Mammals which normally produce several young at one time (such as rabbits, cats, dogs) usually have two uteri, but those which normally produce only one offspring at a time (for example, elephant, horse, man, cow) usually have one uterus.

In your workbook, complete the following sentences under a suitable heading.

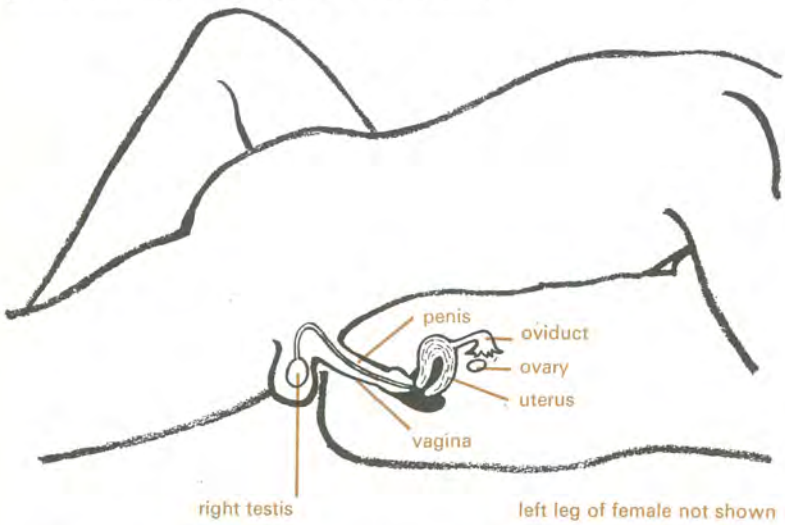
In mammals, the male reproductive systems are very (alike/different).

The female reproductive systems differ mainly in the number of ..... Some mammals have two ....., others have .....

Life before birth

36 Before a young mammal can begin to develop, a sperm from the male parent must fertilize an ovum from the female parent.

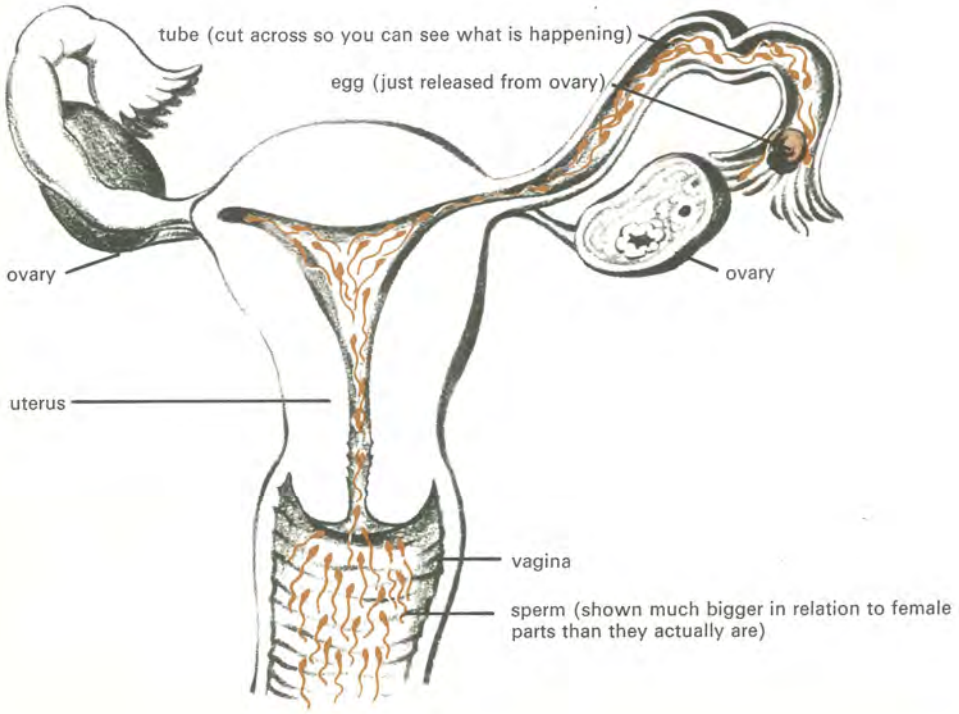
During mating, the penis of the male fits into the vagina of the female. Sperm from the male testes pass through the penis and into the vagina of the female.



Mice mating.

ASEP

From the vagina, the sperm move through the uterus into the oviducts. Here one sperm may join with an ovum which



has been released from an ovary and fertilize it. The number of ova present in the oviducts depends on the animal, but each ovum fertilized can develop into a young animal.

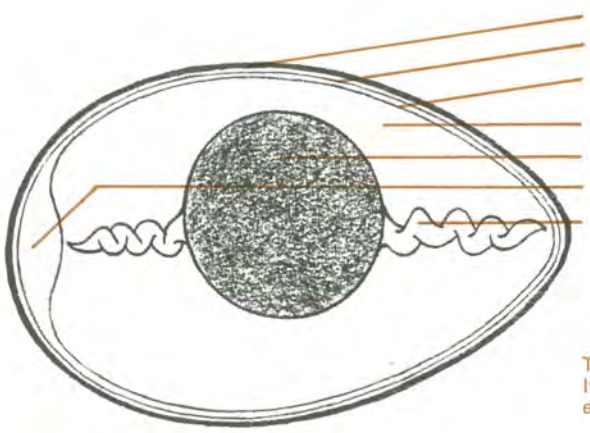
Before you read on, make sure you can answer these questions.

1 Where are the sperm produced?
2 Where are the ova produced?
3 Where does fertilization take place?

In your workbook, write an answer to each of the three questions above. (Be sure to use complete sentences so that if anyone read your notes, they would know exactly what you meant.)

What happens after fertilization?

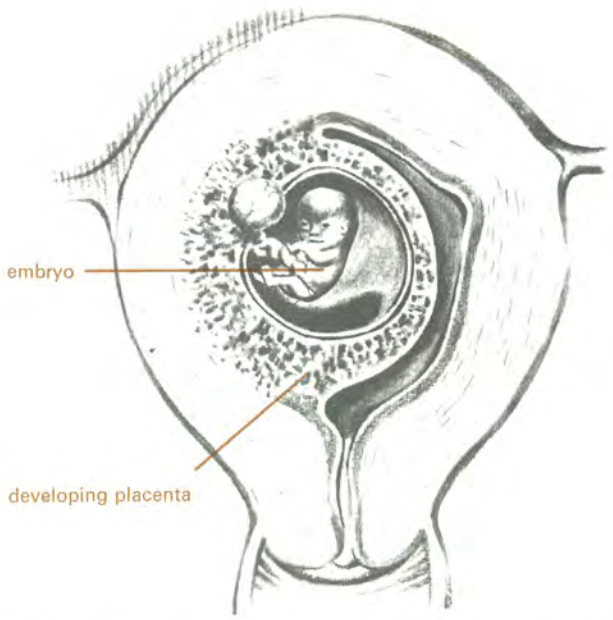
Some animals, such as birds, develop from eggs which contain a food supply. The adult birds protect the egg and keep it warm. The egg supplies the developing chick with food until it has hatched.



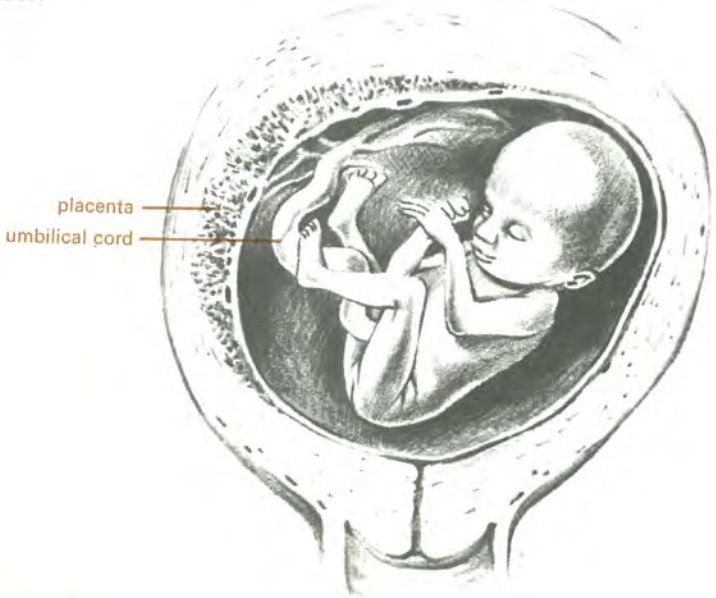
The ovum is a tiny speck, too small to see, on the yolk. If the egg is fertilized, the embryo will feed on the yolk so that as the embryo gets bigger, the yolk gets smaller.

In all mammals except the echidna and platypus, which lay eggs in much the same way as a hen does, the young develop in the uterus of the mother. The mother's body keeps the embryo warm and protected.

Food and oxygen for the developing embryo come from the bloodstream of the mother. These substances pass into the embryo's bloodstream in the **placenta**, a large mass of blood vessels that forms in the wall of the uterus.



The embryo is connected to the placenta by the **umbilical cord**. Blood from the embryo flows through the umbilical cord to the placenta, where it discharges carbon dioxide and other waste products into the mother's bloodstream, and picks up food and oxygen from the mother's blood. It then flows back through the umbilical cord to the embryo. The blood of the embryo does not *mix* with the blood of the mother, but in the placenta the two bloodstreams come close enough to allow substances to pass from one to the other.



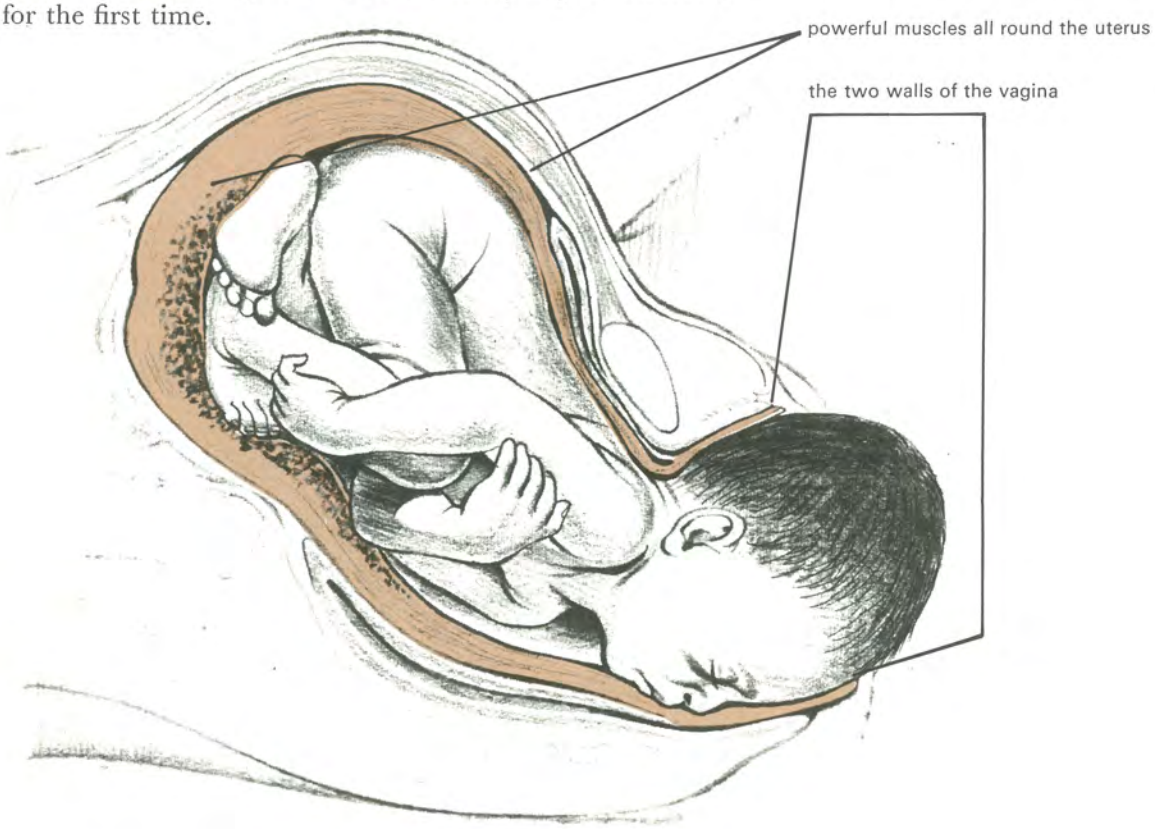
The time spent in the uterus (called the **gestation period**) depends on the kind of animal—an elephant calf takes about twenty months, a human baby takes nine months, a kitten takes nine weeks.

The young organism (or organisms) develop inside the mother's uterus. The gestation period for a human baby is nine months. For a mouse it is only three weeks.

ASEP

Lin Bender

At the end of this time, powerful muscles in the uterus push the young mammal out through the vagina, which widens sufficiently to allow it through. The baby mammal is born. Immediately after birth the baby begins breathing for the first time.



A young mammal is born! Notice the umbilical cord. It is no longer needed because the baby can now breathe and eat for itself. The cord is cut and tied, and the knot will eventually shrivel to form the baby's navel.

Wayne Miller/Magnum

ASEP

This sequence of photographs shows a donkey being born. Unlike human babies, the baby donkey is able to stand on its feet when only a few hours old.

Pictorial Press

42 The change from the protection and warmth of the mother's body to the variable temperature and other hazards outside is a drastic one. At first the young mammal receives food (milk), warmth and protection from its mother but gradually it grows into an independent organism.

Collect Worksheets 8 and 9, fix them in your workbook and fill in the missing words.

Show your work to your teacher, who will tell you what to do next.

The young mammal is fed and cared for by its mother until it is old enough to fend for itself.

Lin Bender

Popperfoto

Associated Newspapers/Popperfoto

Ministry of Tourism, Victoria

Research activities

These activities are designed to help you follow up any ideas about how mammals function that may interest you. You don't have to attempt all the activities, just do the ones you think you would like to do. You may do them in any order, and most may be done either at home or at school.

A page number is given next to each activity so that you can see how much of the main part of this book you need to have covered to give you enough background information for that particular activity.

For each activity you do, write a full report in your book, explaining what you were trying to find out, what you did and what you discovered.

Mouse study · Page 2

Keep some mice or guinea pigs as pets and observe their behaviour in different situations. Most pet shops will have books which will tell you how to look after these animals. The main things to remember are to keep them supplied with food (cubes or pellets from a pet shop, and fruit and vegetable peelings), to make sure that they always have fresh water and that their cage is kept clean.

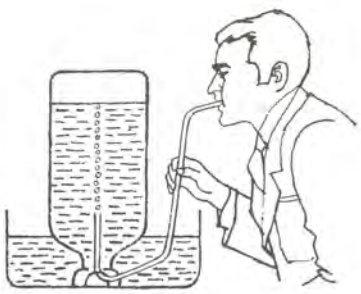
If you have more than one animal, observe how they react towards each other. For example, do they ignore each other? Does one copy another's behaviour? Does one bully the others? Does their reaction vary according to the sex of the other animals?

You could keep a record of the growth of your animals, especially if you have young ones, by weighing and measuring them regularly. Plot your results on graphs.

Investigate as many aspects of your animals' behaviour as you can. Make notes in your book.

ASEP

If one of your pet mice or guinea pigs has a litter of young, you could keep careful records of their growth.



What is your lung capacity? Page 3

Using the following method you can find out how much air your lungs can hold.

Fill a large jar with water and invert it in a larger vessel of water as shown in the diagram. Gently blow out one big breath into the jar through a tube inserted into the neck of the jar.

Put a lid on the jar while it is still under water and then stand it upright on the bench. Use a measuring cylinder to refill the jar, carefully measuring how much water is needed. This equals the volume of air expelled from your lungs.

Repeat this and see if you can increase your lung capacity by taking a bigger breath before you blow into the tube.

Make measurements of the lung capacity of a number of different people. Can you find any relationship between lung capacity and other characteristics such as height, weight, circumference of chest, sex, athletic ability?

Write a report on your findings.

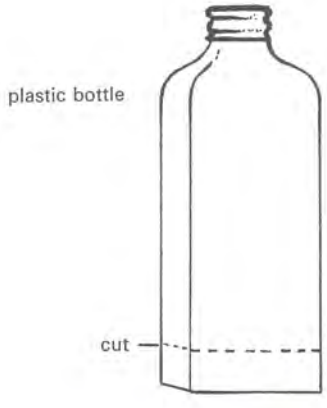
A lung model Page 3

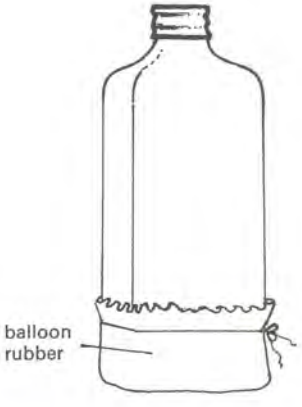
Obtain a plastic bottle, a top that fits the bottle with a piece of glass or plastic tubing pushed through it, some string, a coloured balloon and a piece of balloon large enough to cover the bottom of the bottle.

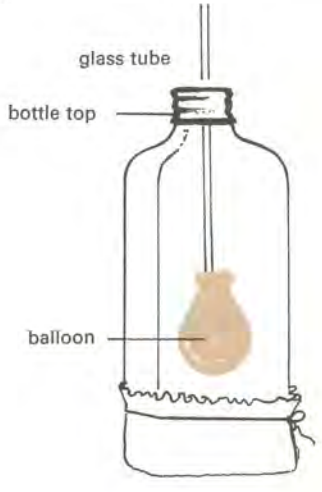
Cut the bottom off the plastic bottle.

Cover the hole at the bottom of the bottle by stretching a piece of balloon across it, using string or thread to keep the balloon rubber in place.

Insert the lower end of the tubing into the neck of the balloon and fasten it firmly. Push the balloon inside the bottle and stopper the bottle tightly.







46 Which part of your model represents each of the following?
the trachea
the chest wall
the lung
the diaphragm
(The diaphragm is the structure in your body that separates the thorax from the abdomen.)

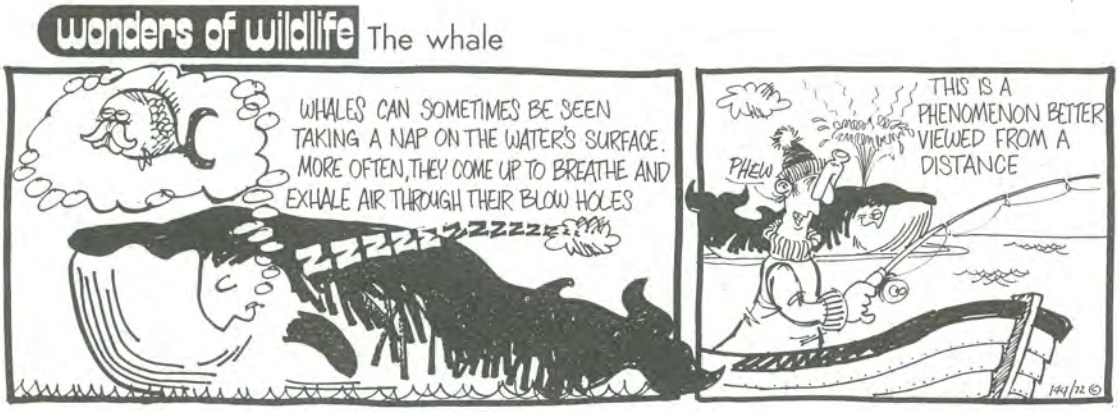
Gently move the rubber at the bottom of the bottle up and down a few times. What do you notice?

Squeeze the bottle in and out. What do you notice?

What movement represents inhaling? What represents exhaling?

How do sea mammals breathe? Page 3

Whales and dolphins are mammals. Unlike most animals that live in the water, they have lungs. See if you can find out how they manage to breathe. The pictures below may give you a clue.



The Herald and Weekly Times

Examine the lungs of a sheep Page 11

It would be a good idea to work with a partner for this activity.

You will need a set of sheep's lungs, a dissecting board, forceps, sharp-pointed scissors, thin string about 30 cm long and a piece of plastic or rubber tubing about 15 cm long.

1 Place the lungs on the dissecting board, with the ventral (front) surface uppermost. (This is the surface from which the heart was cut away.)

2 Locate the trachea (windpipe), the tube leading from the mouth to the lungs. With your fingers you should be able to

feel that the walls are strengthened with firm cartilage rings which prevent the trachea from collapsing.

3 Insert the rubber tubing into the open end of the trachea and tie a piece of string around it, making an airtight connection.

Hold the trachea where the string is tied and blow hard down the tube. Observe what happens to the lungs when you do this. Do they look different when they are blown up?

4 Take hold of a piece of lung tissue in your fingers and squeeze it. What happens? Notice that the lung tissue springs back to its former shape when you take your fingers away. The tissue is elastic.

5 Dampen your fingers and hold them over the end of the trachea while your partner squeezes the lungs in his hands. What can you feel?

6 Follow the trachea down from the throat, cutting away with your scissors any excess tissue attached to the trachea. The trachea divides into two tubes, called the bronchi (pronounced *bron*-kee). One of these tubes, a bronchus (*bron*-kus) leads to each lung.

7 Continue to follow one bronchus, cutting away lung tissue as you go. Notice that the tubes branch, becoming smaller and smaller. The smallest of these tubes are called bronchioles (*bron*-kee-oles).

8 Look closely at the lung tissue that you have cut. Notice the many small blood vessels in the tissue. Notice also that the tissue contains many air spaces.

9 Wrap the remains of the lungs in newspaper and place them in the waste bin. Wash and dry the instruments and the dissecting board.

Draw a diagram of the lungs and label it clearly. Make sure you label all the following: the trachea, cartilage rings, bronchus, right lung, and bronchioles.

How often do you breathe? Page 11

How many breaths do you take in one minute? You will find that this varies depending on what you have been doing.

Count the number of times you breathe in for half a minute. Then run as fast as you can for about 100 metres. When you stop running, check the number of breaths in for

each half minute until the count is the same as it was before you started running. Plot your results on a graph.

Get other people to do this experiment while you count the number of times they breathe in. Compare the results. The more physically fit a person is, the less puffed he will be after the run and the quicker his breathing will return to normal.

Starch to sugar Page 21

Is saliva responsible for the change of starch to sugar?

Collect some saliva in a small beaker.

Crumble some dry (unsweetened) biscuit into a small test tube (A), add some water and then some of the saliva. Keep the tube warm for a few minutes by holding it snugly in your hands.

To another test tube (B) add similar amounts of crumbled biscuit and water, and keep this warm also by holding it in your hands. This is the control. Which factor is present in tube A and missing in tube B?

After a few minutes, test the contents of tube A and tube B for starch and sugar.

Make sure you include your conclusions when you write your report.

Saliva and pH Page 21

If you have done any work on pH before, try this activity.

Collect some saliva in a test tube. Using universal indicator, measure the pH of saliva. Is it acidic or alkaline?

Design and carry out an experiment to test whether saliva works best at its usual pH or when its pH is adjusted to 3. (Use dilute acetic acid to adjust the pH of the saliva if necessary.)

When the kidneys fail Page 26

The kidneys are vital to the body because they remove from the blood waste products which, if left there, would poison the tissues of the body. Most people have two kidneys, though it is possible to survive with only one. When both kidneys have failed, death will result unless something is done very quickly to remove the waste substances from the blood. Many people in this situation have to rely on an artificial kidney machine to do this for them. See if you can find out how a kidney machine works.

In some cases, kidneys can be successfully transplanted from one person to another. However, there are problems

This man is reading the newspaper while the kidney machine is working. Can you find out what it does?

Fairfield Hospital

associated with this type of operation. Unless the person giving the kidney is a close blood relative of the person receiving it, the new kidney is often 'rejected' by the body. The reasons for this are not yet fully understood.

Find out more about kidney and other transplant operations. Are the organs used in such operations always human ones?

Test a urine sample Page 26

Urine is a valuable indicator of a person's state of health and doctors often send patients' urine samples for analysis to assist with their diagnoses.

Test a sample of your own urine with any of the following that you can get hold of.

Testape
universal indicator
Labstix
Clinitest tablets

Make sure you follow carefully the instructions on the bottle or packet.

If you can obtain a sample of urine from a mouse or rat or any of your pets, test that too. Do the results differ from those from your urine?

Diabetes is one disease that alters the chemical composition of the urine. What is diabetes? Find out about its symptoms and treatment.

Lin Bender

These are foods prepared specially for diabetics (people with diabetes). Why do diabetics have to eat special food?

William Harvey Page 24

It has been said that Harvey's greatness lay not only in what he discovered, but also in the methods he used to carry out his scientific investigations. Find out as much as you can about Harvey's research and experiments.

Watch the blood in the capillaries Page 24

Soak the tip of one finger in cedarwood oil (or some other very fine clear oil) for two or three minutes, making sure that the skin at the base of the fingernail is covered with oil. Then examine the skin overlapping the base of the fingernail with a hand lens, under a very strong light. If you watch carefully you may see the blood moving in tiny streams through the capillaries. Describe in detail everything you see.

Valves in the veins Page 24

You can investigate the valves in the veins as Harvey did.

You will need to do this with someone else.

Ask your partner to tie a handkerchief tightly around your upper arm. This will increase the prominence of veins in the lower arm (the veins appear blue).
Warning: Be sure to leave the handkerchief on your arm *no longer* than five minutes.

Select a prominent vein in the inner side of your forearm—preferably one which is unbranched. At the end of this vein nearest the wrist, press firmly on the vein with your finger to stop the flow of blood through it.

Keep the pressure on while your partner strokes the vein firmly towards the heart. Note the effect on the vein. Now release the pressure of your finger and observe what happens.

Repeat the above procedure, but this time stroke the vein towards the wrist. Note the effect on the vein this time.

Can you see a series of little swollen sections in the vein? At the junctions between each of these swollen parts are little valves which prevent the blood from flowing away from the heart.

Write an account of what you observed.

How do twins happen? Page 43

Just over one per cent of all human births (that's a bit more than one in every hundred) results in twins. Very occasionally three, four or even more babies are born at once.

Twins are of two types. Either they are identical—that is, they look the same, are the same sex, same colouring, build, etc.—or they are non-identical or *fraternal*. Fraternal twins are often of different sexes and are no more alike than brothers and sisters generally are.

It is not known exactly *why* twins are formed, but we do know *how* they form. See if you can find out from books how different types of twins are formed.

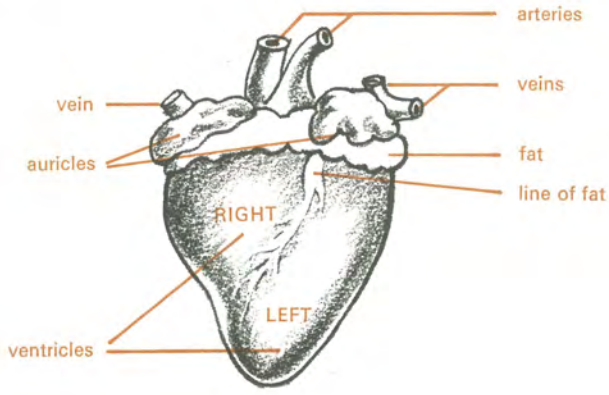
Advertiser Newspapers Ltd

Christopher and Jonathan are identical twins.

Examine a heart Page 24

The human heart is fairly similar to a sheep's heart; it is about the same size and has a similar structure.

Obtain a sheep's heart and a dissection board. Pick up the heart and with your fingertips feel that some parts are very firm and others are rather flabby. Where is the firmest part? At the wide end of the heart, notice various tubes and openings.



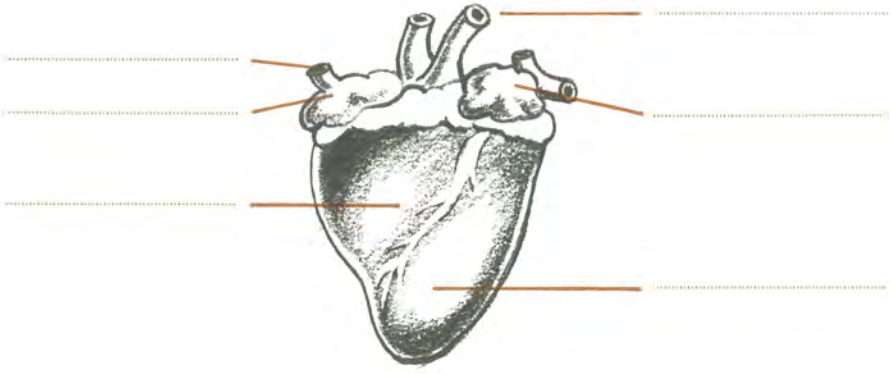
Place the heart on the dissecting board, with the line of fat passing diagonally from the top right-hand side to the lower left-hand side. In this position the front or **ventral** surface is facing you.

Note that the right side of the heart (that is, the animal's right) is on *your* left; the left side of the heart is on your right.

Find the two frilly fleshy structures at the top of the heart. These are part of the **auricles** (pronounced *orr*-i-kuls). If you can, find the thin-walled tubes, the veins, leading into the auricles.

The remainder of the heart (which feels firm to the touch) consists of two thick-walled structures, separated by the diagonal line of fat. These are the **ventricles** (pronounced *ven*-trick-uls). If you can, locate the two thick-walled tubes, the arteries, one leading from each ventricle.

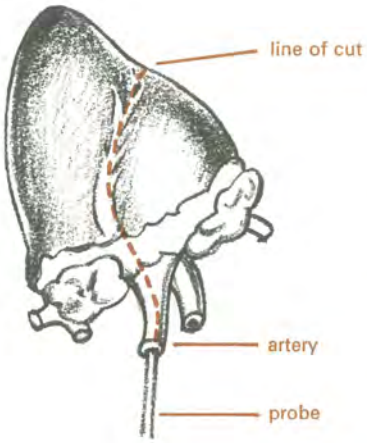
Make a drawing of the heart, similar to the one below, and include the following labels in the appropriate places: right ventricle, left ventricle, right auricle, left auricle, an artery, a vein.



If you wish to dissect the heart, continue with the next activity.

Dissection of a heart Page 24

To dissect your sheep's heart, follow the instructions below. You will need a dissecting board, a pair of sharp-pointed scissors and a blunt probe (a knitting needle or meat skewer will do). Do not cut unless you are sure you know where you should be cutting.



1 Place the heart on the dissecting board with the auricles towards you.

2 Find the artery which leads from the right ventricle by gently pushing the handle of the probe into it (as in the diagram on the left). Leave the probe in the artery.

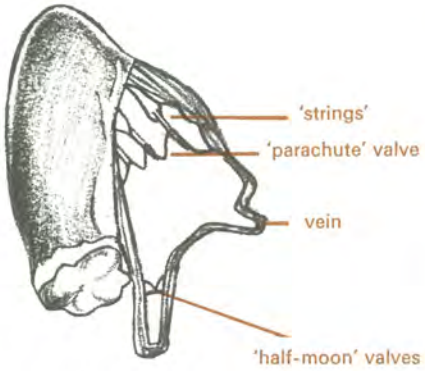
3 Using sharp-pointed scissors, cut along the artery parallel to the probe handle. Cut to the end of the line shown in the diagram on the left.

4 Near where the artery opens into the ventricle, look for three pale flaps of tissue, shaped like half-moons, which are probably lying flat against the wall of the artery.

5 Investigate these flaps—the valves—with the blunt end of the probe. Notice the thin sheet of tissue, or **membrane**.

6 Lift the wall of the right ventricle and look inside the heart. Note the thickness of the ventricle wall compared with the thinner wall of the auricle.

7 Look for parachute-shaped valves between the auricle and the ventricle, held down by white 'strings' to the wall of the ventricle. You may not be able to see the membrane of the valve very easily unless you use the probe to find it.



8 Cut upwards through the valves to where the vein joins the auricle, then across to the artery, as shown in the diagram on the left.

9 Cut open the left side of the heart in exactly the same way as the right. Notice carefully the thickness of the walls of the *left* ventricle in comparison to the right ventricle. Can you account for this difference?

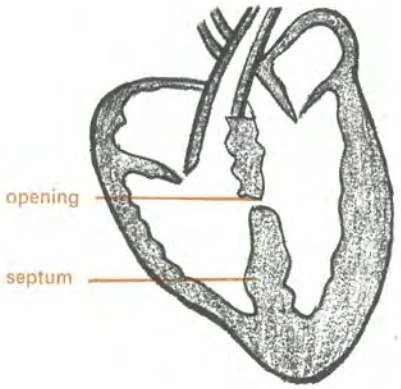
If possible, look in a book for more detailed information about how the heart works. You may be able to find out exactly what each part of the heart does.

Make a careful drawing of your dissected heart and label all the structures clearly. If your teacher has a dissected heart on display, compare it with the one you have dissected.

Show your dissection to your teacher and ask what you should do with it. Wash your board and instruments and dry them.

Hole in the heart Page 24

The right and left sides of the heart are completely separated one from the other. The dividing wall is called the **septum.** Sometimes an opening occurs in the septum of the heart. This condition is called 'hole in the heart'. If this occurs, not all the blood returning to the heart from the body passes through the lungs. Instead, some blood leaks through to the left side of the heart and is pumped around the body again without a renewed supply of oxygen.



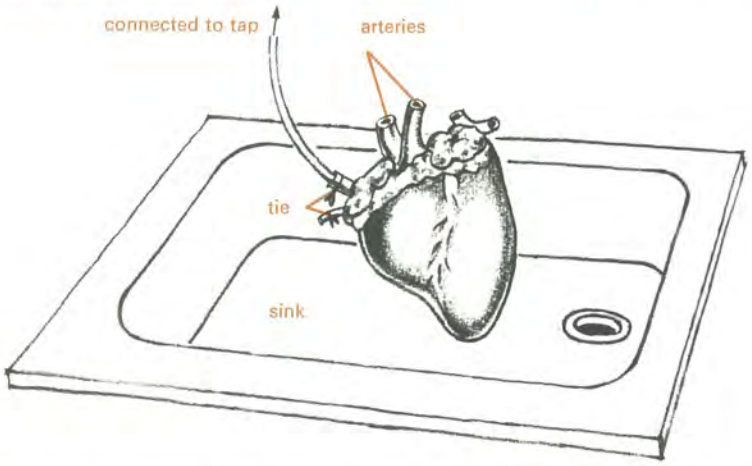
A person who has a hole in the heart suffers from tiredness and lack of energy—so much so that he cannot carry on a normal life.

See if you can find out more about the symptoms of this complaint and about the surgery which is performed to bring about a cure.

The valves of the heart Page 24

To investigate the valves of the heart you will need a whole sheep's heart, a length of rubber tubing fitted onto a tap over a sink and some cotton thread.

1 Tie off one of the veins leading to the right auricle (as in the diagram below). Fit the free end of the rubber tubing to the other vein leading to the right auricle, and tie the join with thread.



2 Get someone to turn on the tap so that the water runs *slowly* into the heart, while you hold the heart firmly in your hands over the sink. Notice where the water runs out.

Keep the water running slowly and squeeze the ventricles firmly with a pulsating movement. What happens this time?

3 Turn off the tap. If you look down an artery you may see the thin valves floating out across the entrance.

4 Take the tubing out of the vein and gently insert the free end into an artery. Turn the tap on *gently*. Notice what happens to the water this time. Can you explain this? *Note:* It is important not to push the rubber tubing in too far. Why?

When you write your report, try to include an explanation for everything you saw happen.

Variations in heart beat Page 23

Design and carry out an experiment to test the effect of exercise on heart beat. How does exercise affect heart beat? How long does it take to return to normal? Does doubling the amount of exercise double the effect? Does exercise affect everybody's heart beat in the same way?

You could also investigate the variation, if any, of heart beat with age. If possible, test several people in each of the following categories:
very young children
school children
young adults
old adults

Find the average heart beat for each category and compare your results. Which age group has the highest average heart beat? Which has the lowest? Can you think of any reasons for this?

Strange mammals Page 43

The animal in the photograph on the left is an armadillo, the one on the right is a pangolin. Despite their scales, they

Popperfoto

American Museum of Natural History

are both mammals. The pangolin eats ants, and has a sticky tongue longer than its head and body combined with which to catch them. Both these strange animals curl up when threatened, so that the attacker is faced with a ball covered in scaly armour.

Find out where these animals come from, how they give birth and care for their young, and anything else you can about the way they live.

Gravity and the circulation Page 24

The heart pumps blood through the arteries as far as the capillaries. After that, blood oozes through the veins back to the heart, helped along a little by contraction of the muscles around the veins. When a person has been standing still for a long time, blood tends to collect in his legs because there has been no muscle movement to help his blood on its long climb against gravity back to his heart. Thus there is less blood to be pumped to the rest of his body, particularly the brain.

Can you find out what sometimes happens as a result of this? What is the remedy?

Composition of the blood Page 24

What does blood consist of? Try to find out from reference books what is in blood. If you have access to a microscope, you may be able to examine a drop of blood under it.

Human blood is divided into four different types, known as groups. Everyone belongs to one of the groups, which are called A, B, AB and O. This is a very important factor to be taken into account when blood transfusions are given. A person must not be given blood that comes from a blood group *incompatible* with his own. Find out more about the blood groups. Which is the most common?

Muscles and movement Page 11

You will need a freshly killed mouse or rat, a dissecting board and sharp-pointed scissors.

Cut and pull back the skin on one leg of the mouse. If you hold the animal firmly with one hand and pull on the skin, you will expose the muscles lying just under the skin. You may need to get someone to snip the skin carefully with the scissors while you peel it back.

With your fingers, pull on a muscle and notice what part of the leg moves.

Can you see the structure to which the muscle is attached? You may need to push the other muscles aside to see the attachment clearly.

The silvery strands connecting the muscle to the bone are called **tendons**.

For nearly all movements of the animal, one or more muscles contract. This contraction pulls on the tendons at the end of the muscle, causing the bone to move.

If you wish, continue your dissection to investigate other muscles and bones of the animal.

What have you learned?

58 The questions below are designed to help you think back over the work of this unit. You will probably need to look over your workbook notes and you may wish to look back at relevant sections in this book. (The page number next to each section will help you if you wish to do this.)

Questions 1 to 6 concern the *structure* of a mammal. Questions 7 to 25 concern the way these structures *function* in a living mammal.

Look at each question in turn and *think* about the answer. If you wish, write the answer in your workbook. It is probably a good idea to write down the answers you are not sure about. As soon as you have answered each question, check in your workbook or this book to make sure that your answer is both *correct* and *complete*.

QUESTION	PAGE
1 What are the structures involved in breathing in a mammal?	15
2 What are the structures involved in digestion in a mammal?	20
3 What are the structures involved in the formation and storage of urine in a mammal?	12
4 What are the structures involved in circulation in a mammal?	24
5 What are the structures involved in reproduction in a female mammal?	34
6 What are the structures involved in reproduction in a male mammal?	33
Source of energy	
7 What is the source of energy for animals?	22
8 From which two main sources is man's food obtained?	16
9 For what purpose, other than as a source of energy, does a mammal require food?	16, 20
10 What happens to food in the digestive system?	20
Release of energy	
11 Name the process by which energy is released in mammals.	22
12 Where (two places) do the materials needed for respiration enter the human body?	22
13 Where does respiration take place?	22
14 What is breathing?	2

QUESTION	PAGE
Transport of materials	
15 What substance is responsible for transporting materials around the body of a mammal?	22
16 What kind of blood vessels carry blood away from the heart?	24
17 Name the tiny blood vessels connecting veins and arteries.	24
18 What keeps the blood moving around the body?	22
19 Why must the heart beat even when the animal is asleep?	22
20 From which organ in the body is oxygen absorbed into the blood?	24
21 How does food reach all parts of the body where it is needed?	24
Reproduction	
22 Name the method of reproduction which involves female and male gametes.	30
23 In mammals, where are the sperm produced?	33
24 In mammals, where does fertilization take place?	37
25 Where does the mammalian embryo obtain food and protection?	37

When you are sure you can answer all the questions correctly, ask your teacher what you should do next.

Answers

Progress check 1 (page 14)

1	trachea stomach kidney		oesophagus faeces intestine	1 mark each
2	mouth	8	stomach	1 mark each
3	trachea	9	kidney	1 mark each
4	oesophagus	10	intestine	1 mark each
5	heart	11	bladder	1 mark each
6	lung	12	anus	1 mark each
7	liver			1 mark
			TOTAL	17 marks

Add up your marks.
If you scored 0 to 15 marks, turn to the section 'What does each part of the body do?' on page 15.
If you scored 16 or 17 marks, turn to the section 'What happens to the food you eat?' on page 16.

What does each part of the body do? (page 15)

Breathing	lungs trachea
Forming and storing urine	bladder kidneys ureters

Progress check 2 (page 27)

1	digestion ureter circulatory	capillary saliva artery	1 mark each
2	(c)		1 mark
3	(b)		1 mark
4	(a)		1 mark
5	(b)		1 mark
6	(c)		1 mark
7	(b)		1 mark
8	(a)		1 mark
9	(b)		1 mark
10	(d)		1 mark
11	(a)		1 mark
		TOTAL	16 marks

Add up your marks.
If you scored 0 to 14 marks, turn to the section 'Substances moving around' on page 29.
If you scored 15 or 16 marks, turn to the section 'Handing on life' on page 30.

Handing on life (pages 33, 34)

1 kidney
2 ureter
3 bladder
4 sperm duct
5 testis
6 penis

A kidney
B ureter
C oviduct
D uterus
E vagina
F ovary
G bladder